UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

OFFICE OF
ENVIRONMENTAL
CLEANUP

November 9, 2016

MEMORANDUM

SUBJECT: EPA Position regarding the Lower Willamette Group's (LWG), Legacy Site Services' (LSS) and Union Pacific Railroad Company's (Union Pacific) June 22, 2016 Request for Dispute Resolution on EPA June 2016 Feasibility Study (Lower Willamette River, Portland Harbor Superfund Site, USEPA Docket No: CERCLA-10-2001-0240)

FROM: Kristine Koch
Remedial Project Manager

TO: Sheryl Bilbrey, Director
Office of Environmental Cleanup

The LWG and individual members LSS and Union Pacific invoked formal dispute in accordance with Section XVIII of the Administrative Order on Consent for Remedial Investigation/Feasibility Study dated September 28, 2001, as amended on June 16, 2003 and April 27, 2006 dated June 27, 2005. The LWG's formal dispute statement and supporting documentation were submitted in letters from the LWG, LSS and Union Pacific and dated June 22, 2016.

The enclosure constitutes the U.S. Environmental Protection Agency's position regarding the LWG's, LSS's and Union Pacific's dispute statements. The LWG's, LSS's and Union Pacific's June 22 letters and associated supporting documentation previously transmitted to you along with EPA's Response and cited AR documents constitute the administrative record ("Dispute Record") for deciding this dispute unless you request additional information.

The LWG, LSS and Union Pacific are formally disputing EPA's June 2016 Feasibility Study for the Portland Harbor Superfund site. Their main argument is that the EPA's June 2016 FS should not be used as a basis for a Record of Decision for the Portland Harbor Superfund Site and that the alternatives analysis in the LWG's 2012 FS provides an adequate basis for selecting a remedy at the Site. In summary, EPA's position is that the LWG's 2012 FS was inadequate and lacked scientific rigor such that EPA disapproved the document in December 2013; thus, EPA wrote the 2016 FS using concepts and information from the LWG's 2012 FS that were acceptable and supplemented it with additional scientific information and analysis that are consistent with CERCLA, the NCP, and relevant EPA policy and guidance as discussed further in the enclosure.

Enclosure

cc: Sheila Fleming, ECL
Lori Cora, ORC
Jim Woolford, OSRTI
Elizabeth Allen, OEA

I. INTRODUCTION

On September 28, 2001, ten parties entered into an Administrative Settlement and Order on Consent to perform the remedial investigation and feasibility study for the Portland Harbor Superfund Site (hereinafter referred to as the "RI/FS AOC"). [**AR Doc # 711519]** The Respondents to the RI/FS AOC call themselves the Lower Willamette Group ("LWG"). Section XVIII. of the RI/FS AOC provides a dispute resolution process for any disputes concerning "activities or deliverables required under the order." On February 4, 2016, EPA and the LWG mutually agreed that it would be more effective and efficient if EPA finalized the Feasibility Study. [**AR Doc # 100003435]** EPA and the LWG also agreed that the LWG could dispute the final FS within 14 days of publication of the final FS along with the Proposed Plan. Specifically, the February 4 letter [Page 2] agreement stated:

> The EPA will allow the LWG AOC signatories to dispute the final FS that the EPA produces and publishes along with the Proposed Plan. In making this agreement, if any LWG AOC signatories decide to dispute the final FS under Section XVIII of the AOC, the LWG signatories must submit their Dispute Statement within 14 days of the publication of the Proposed Plan. The Dispute Process under the AOC would be streamlined by proceeding directly to the formal determination phase wherein the Director's decision is anticipated to be made simultaneously with the agency's remedy decision after considering all public comments along with the disputed issues. In accepting this agreement, the LWG agrees that, because the dispute process will be conducted during the public comment period, the LWG's Dispute Statement will be placed in the administrative record and the dispute process will be conducted consistent with requirements for public participation for the proposed remedy decisions under CERCLA the NCP, and federal law.

Section XII., Paragraph 1 of the AOC [Page 22] provides that EPA retains responsibility for preparation and release of the Proposed Plan and Record of Decision. The FS is a separate and distinct document from the Proposed Plan. Likewise, under the terms of the AOC, the Proposed Plan was not an "activity or deliverable" that the LWG was required to produce. Therefore, the scope of this dispute is limited to issues concerning the June 2016 FS **[AR Doc # 840000 through 840019]**, not the Proposed Plan. Additionally, consistent with the agreements reached in the February 4 letter, EPA's disapproval of the LWG's 2012 FS also is not within the scope of this dispute.

Moreover, throughout the LWG's dispute statement, they ask for an explanation or rationale for why EPA's final FS was changed from an earlier draft FS, hereinafter the August 2015 FS. As stated above, the subject of the dispute process is only EPA's final FS, so the responses below focus on the particular issues raised with the final FS and we do not explain every change made from earlier drafts unless needed to fully respond to a specific final FS issue.

EPA published the Proposed Plan and FS, along with the administrative record, on June 8, 2016. On June 22, 2016, seven out of the ten AOC signatories submitted three separate Dispute Statements.[1] **[AR Doc # 100031247, 100031251, 100031255, 100031259,**

[1] The seven LWG members are: Arkema, Inc., Chevron, U.S.A. Inc., Evraz, Inc. N.A., Gunderson LLC, NW Natural, TOC Holdings Co. and Union Pacific Railroad Company.

100031265, 100031266, 100031275, 100031277, 100031278] The collective group of seven submitted a Dispute Statement, in which Arkema, Evraz, Gunderson, NW Natural, TOC Holdings, Inc. and Union Pacific attached additional issues in an Appendix to their dispute statement. LSS, Inc. (agent for Arkema, Inc.) and Union Pacific submitted separate Dispute Statements as well. Below are EPA's responses to all three Dispute Statements. We have organized the responses by each Dispute Statement, i.e., LWG Response, Arkema Response and Union Pacific Railroad Response. However, if an issue was already raised and discussed, EPA provides a reference to where the discussion is provided.

The LWG, including each individual Respondent to the RI/FS AOC, has had significant input and opportunities to comment on EPA's FS for the Portland Harbor Site. EPA began discussing its ideas and proposals for modifications to the LWG's 2012 draft FS since at least December 2012 when EPA notified the LWG that it could not approve the LWG's 2012 draft FS. **[AR Doc # 100007299]** EPA shared and discussed its draft modifications on FS Section 1 starting on July 8, 2014, and made changes based on the LWG's requested modifications and issues to that Section. **[AR Doc # 100009736, 100010079, 100010083, 100010101, 100010298, 100010490, 100010848, 100010854, 100010876, 100011126, 500003669, 100015709]** Likewise EPA provided and discussed modifications to Section 2 on February 23, 2015 and made changes to that chapter as a result of the LWG's requested modifications and issues to that Section. **[AR Doc # 100013186, 100015799, 100015924, 100015925, 100013288, 100017731, 100015709]** Sections 3 and 4 of the draft modified FS were shared on July 29 and August 18 2015, respectively, and the LWG had the opportunity and provided significant comments on those last two sections to Region 10. **[AR Doc # 100017731, 100003852, 100016145, 100015709, 100003806]** The LWG also had the opportunity to provide recommendations for the proposed remedy to the National Remedy Review Board and Contaminated Sediment Technical Advisory Group in which they also provided their comments on the draft modified FS. **[AR Doc # 1412910]** Over all of this time, EPA and LWG had meetings at both the technical staff level and senior management levels regarding the direction EPA was going in its modifications to the FS. Every step of the way, EPA considered the LWG's comments in producing the 2016 FS. EPA has been transparent and open with the direction and scope of the modifications that it determined was needed to the LWG's 2012 draft FS. The LWG has had significant opportunities to raise comments and issues. In addition to this dispute opportunity, the LWG collectively or as individual commenters had the opportunity and have taken advantage of their rights to submit public comments on the Proposed Plan and administrative record through the public participation process and comment period on the Proposed Plan.

After considering all of the Dispute Statements and responses, the fundamental conclusion is that EPA's 2016 FS contained appropriate remedial alternatives that were evaluated consistent with the NCP and EPA guidance. The development and evaluation of the alternatives adequately reflected the scope and complexity of the remedial action and site problems being addressed. Some minor textual or technical errors or omissions were found while responding to some of the dispute issues or other public comments many of which have been corrected in response to comments; however, none of the errors or omissions were fundamental nor undermine the basis for the final remedy decision documented in the Record of Decision. The 2016 FS as supplemented by this Responsiveness Summary and all of the corrections, clarifications, and supplemental analysis contained herein along with remainder of the administrative record support the selected remedy documented in the Record of Decision.

II. LWG DISPUTE STATEMENT RESPONSE

The LWG's dispute statement objected to EPA's modifications to the LWG 2012 draft FS and stated three bases for their objections to the 2016 FS, which are summarized below:

1. EPA's conclusions that alternatives B and D are not protective or fail to comply with ARARs is based upon methods that are inconsistent with the remedial investigation and baseline risk assessments. EPA's failure in the June 2016 FS to evaluate protectiveness in a manner consistent with the approved risk assessments and with sound risk management principles results in large areas being designated for active cleanup where risks are either not present or cannot be meaningfully reduced through a sediment cleanup.
2. EPA's June 2016 FS lacks a complete and transparent evaluation of the long- and short-term effectiveness and cost-effectiveness of its alternatives, as well as the degree to which those alternatives reduce the toxicity, mobility or volume of hazardous substances, including PTW, through treatment. EPA's 2016 FS also: (1) has inadequate cost estimates; and (2) does not have an evaluation of how long it will take each alternative to achieve cleanup levels. Therefore, a proper analysis of alternatives would not result in selection of Alternative I.
3. EPA's FS fails to articulate a framework and schedule for implementation by which each alternative can be compared. EPA's 2016 FS should describe what adjustments to the selected cleanup are possible or how adjustments would be determined. EPA should identify in its alternatives development and decision trees what refinements can be made through remedial design and implementation.

The LWG raised numerous issues in support of one or more of their objections; some of which were very general and others more specific. Responses to their issues are provided below, and demonstrate that EPA's 2016 FS appropriately evaluated protectiveness in a manner consistent with the NCP, including appropriately applying the conclusions from both the Baseline Human Health Risk Assessment ("BHHRA") **[AR Doc # 713364]** and Baseline Ecological Risk Assessment ("BERA") **[AR Doc # 1432515 and 1432516]**, where appropriate. Likewise, EPA's 2016 FS complies with the NCP and is transparent about the long and short-term effectiveness of each alternative as well as how all of the other seven NCP criteria were evaluated. Lastly, neither the NCP nor EPA guidance requires a FS to provide a framework and schedule for implementing each alternative, nor to describe what adjustments are possible in implementation. EPA's 2016 FS did, however, identify throughout the report various information, data and analysis that would be needed for remedial design.

The following provides each issue in italic text as discussed in detail in the dispute document, including footnotes and references when they added further technical support for dispute issue, and follows with EPA's position on each of the disputed issues in regular text. Since these three issues raised by LWG had many parts, EPA has provided numbering to allow reference between issues raised by the LWG and by individual LWG parties that have submitted dispute statements.

<u>**LWG Dispute Issue 1**</u>

EPA's conclusions that certain alternatives are not protective or fail to comply with ARARs are based upon evaluations that are inconsistent with the approved remedial investigation and baseline risk assessments and fail to apply appropriate risk management principles.

LWG Dispute Issue 1a:

EPA has not explained why Alternatives B and D are not protective of the environment. EPA believes that all alternatives (except the "no action" alternative) are protective of human health. However, contrary to its August 2015 FS, EPA has now identified Alternatives B and D as not or possibly not protective of the environment.[9] *As best we can tell, EPA has changed its conclusion about Alternatives B and D based largely on its revised approach to benthic risk.*[10]

9 In part, EPA bases its determination that Alternative B and D may not be protective of ecological risk on the fact that institutional controls do not effectively prevent exposure by ecological receptors. However, all alternatives rely to some extent on institutional controls, and this was also the case with all alternatives in the August 2015 FS.

10 The LWG has previously commented that EPA should use the Comprehensive Benthic Risk Areas (CBRA) approach previously developed based upon the approved BERA to evaluate benthic risks consistent, and the NRRB commented that EPA should revisit the benthic approach for the final FS. National Remedy Review Board and Contaminated Sediments Technical Advisory Group Recommendations for the Portland Harbor Superfund Site (EPA, December 31, 2015), p. 4.

EPA Position:

The evaluation of overall protection of human health and the environment for Alternatives B and D is discussed in Sections 4.2.2.1 and 4.2.3.1 of the 2016 FS. EPA concluded that these alternatives were protective of human health because institutional controls can be set in place to ensure protection until such time as cleanup levels are achieved. Since institutional controls cannot be placed to ensure protection of the environment, EPA concluded that these alternatives were unlikely to be protective of the environment. The determination was not made solely based on benthic risk as purported by the Respondents but rather on a more broad-based evaluation consistent with EPA guidance as discussed in more detail below. As stated in Sections 4.2.2.1 and 4.2.3.1 of the 2016 FS, the determination of protectiveness is drawn from the evaluation of all the RAOs and the uncertainty analysis presented in Appendix I. Protection of the environment draws from RAOs 5, 6, 7, 8 and 9: RAO 6 had post-construction HQ of 34 for BEHP.

Based on recommendations from the NRRB/CSTAG (see NRRB/CSTAG comment on Remedy Performance, p. 5), EPA performed an uncertainty analysis of each alternative to determine the likelihood that the Alternative would significantly different from the No Action alternative. This analysis was presented in Appendix I of the 2016 FS, and the conclusion was that Alternative B post-construction SWACs were statistically indistinguishable from the No Action alternative and that the post-construction SWACs for Alternative D were still within the margin of error relative to no action. Since the No Action alternative was deemed to not be protective, EPA reasons that Alternatives B and D are also not protective since Alternative B was statistically indistinguishable from the No Action alternative, and Alternative D was only slightly better for PAHs and PCBs (the SWAC from the DDx RAL for Alternative D were also statistically indistinguishable from the No Action alternative).

As stated in EPA's RI/FS Guidance (USEPA 1988), "The overall assessment of protection draws on the assessments conducted under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs." EPA's assessment was that an insufficient amount of active remedy was conducted under these alternatives to ensure that the environment would be protected in a reasonable time frame, if at all (see discussion of long-term and short-term effectiveness in Sections 4.2.2.3, 4.2.2.5, 4.2.3.3, and 4.2.3.5 of the 2016 FS).

With regard to footnote 10, the Comprehensive Benthic Risk Approach (CBRA) developed by the LWG on their own initiative provided in the LWG's 2012 FS (Appendix P); it was not done as part of or consistent with the BERA as stated by the Respondents. EPA disapproved the LWG's 2012 FS, including the CBRA, in a letter dated December 18, 2012. **[AR Doc # 100007297, 100007298, 100007299]** Comment 1 attached to EPA's disapproval notice noted that the benthic risk evaluation provided in the LWG's 2012 FS would need outstanding issues to be resolved. EPA had started working with the LWG to resolve outstanding issues, but found that the approach was inconsistent with CERCLA, the NCP, and EPA policy and guidance in that it was based on bioassays and models which were not linked to hazardous substances released at the Site. The NRRB/CSTAG recommended that EPA's PRGs for benthic risk be consistent with the benthic SQVs in the BERA (See NRRB/CSTAG comments on Human Health and Ecological Risk, **AR Doc # 100001536**), but were silent on the approach to use to evaluate benthic risk as purported by Respondents.

LWG Dispute Issue 1b:

EPA made extensive changes to the benthic approach for this FS, but those changes are still inconsistent with the comprehensive benthic risk approach contained in the approved Baseline Ecological Risk Assessment (BERA). The FS states: "The protection of benthic species to [sic] contaminated sediment is evaluated using the benthic risk area defined by an order of magnitude greater than the RAO 5 PRGs. The post-construction interim target for RAO 5 was established at 50 percent reduction in the area posing unacceptable benthic risk." So, instead of using the Comprehensive Benthic Risk Area (CBRA) approach previously developed collaboratively with EPA and the LWG using multiple lines of evidence, EPA now maps benthic PRG exceedance factors on a point-by-point basis and uses a 10 times exceedance factor to identify areas of concern. EPA then concludes that if 50% of this area is actively remediated, the alternative is "protective" on an interim basis. It is completely unclear how this new method is: 1) in any way more accurate or consistent with the BERA; and 2) more predictive of benthic risk or the effectiveness of the alternatives, as compared to simply using the previously developed CBRA, which are entirely consistent with the BERA.[12]

12 Further, benthic risk models do not honor the measured data. Although the LRM and FPM are model predictions using data from the toxicity tests conducted with site sediments, some of measured data is not honored. Any modeled risk for benthic invertebrates that ignores actual toxicity testing results needs to be assessed in weight-of evidence and river-mile specific decision-making. The benthic risk footprints should not extend into areas shown to have a lack of toxicity based on actual laboratory toxicity tests. Though EPA states measured toxicity data were reviewed to evaluate correlation with model predictions (EPA June 2016 FS Appendix D, p D-31), the resulting areas are not consistent with the BERA.

EPA Position:

See EPA's position to LWG's dispute issue 1a regarding the CBRA. The LWG's dispute statement does not provide a clear or specific basis for why the CBRA should be used instead of the BERA and the 2016 FS alternatives evaluation approach. The rationale for the approach used in the 2016 FS is explained below.

In the BERA, impairments in survival and growth (expressed as biomass) were directly measured at nearly 300 locations in site-specific sediment toxicity tests with two benthic invertebrate species, approximately 20 percent of the total number of sediment samples collected for chemical analysis. The co-occurring sediment contaminant concentrations in sediments where toxicity was observed were used in the development of two site-specific predictive models of sediment toxicity, the floating percentile model and the logistic regression model. Contaminant concentrations predicted to be toxic from these two models, as well as the empirical data, were used to evaluate benthic risk on a point-by-point basis in the final BERA. The two models are also the source of many of the RAO 5 sediment PRGs for ecological risk. The PRGs for RAO 5 were the SQVs derived in the BERA and are thus consistent with the conclusion of the BERA.

The comprehensive benthic risk area developed by EPA is shown in Figure 4.1-1 of the 2016 FS and is the cumulative footprint of all RAO 5 PRGs. Mapping of benthic risk areas based on a point-by-point PRG exceedance is justified due to the limited mobility of many of the benthic species. This means that some benthic species are exposed to contaminant concentrations posing unacceptable ecological risks (defined as the RAO 5 PRGs) for their entire lifetime. Additionally, benthic species are likely exposed to sediment contaminant concentrations for a sufficiently long exposure duration that results in contaminant bioaccumulation to concentrations (the RAO 6 PRGs) posing risks to aquatic-dependent wildlife species that prey on benthic species.

Under EPA's Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments – Interim Final (June 1997) adverse effects on populations can be inferred from measures related to impaired survival, reproduction and/or growth. A subsequent EPA Policy memorandum (Issuance of Final Guidance: Ecological Risk Assessment and Risk Management Principles for Superfund Sites, OSWER Directive 9285.7-28 P, October 7, 1999) states that ecological risk assessments are intended to protect local populations and communities of biota. Contaminant concentrations that are expected to protect local populations and communities can be estimated by extrapolating from effects on individuals and groups of individuals using a lines-of-evidence approach. This approach was extensively used to evaluate ecological risks at Portland Harbor. However, the conclusions of the BERA provide for which contaminants are posing unacceptable risk based on those lines-of-evidence (site-specific toxicity tests, bioaccumulation models, and species diversity studies; BERA Table 3-1). These are all based on empirical site data and these lines-of-evidence cannot be used to determine effects to the benthic population through means other than empirical testing post construction.

In the 2016 FS, PRGs are developed for those hazardous substances that are posing unacceptable risk at the Site. EPA adopted the site-specific SQVs from the BERA for RAO 5 consistent with the recommendations of the NRRB/CSTAG. These footprint of each PRG was evaluated against the L2/L3 exceedances from the bioassays and both predictive models to determine if the benthic risk coincided with the release of these contaminants. The maps presenting that information is presented in the 2016 FS, Appendix D11. EPA used best professional judgement to not address all benthic risk through dredging and capping and allow for some benthic risk to be addressed through MNR. However, in conducting the evaluation of alternatives, it is necessary to discuss the overall protectiveness. Since a model is not available to determine if these PRGs will be achieved in a reasonable time frame, EPA used best professional judgement to evaluate overall protectiveness for RAO 5 in the 2016 FS (Section 4.1-3, p.4-8) as:

> The protection of benthic species to contaminated sediment is evaluated using the benthic risk area defined by an order of magnitude greater than the RAO 5 PRGs. The post-construction interim target for RAO 5 was established at 50 percent reduction in the area posing unacceptable benthic risk. This is acceptable because protection of the benthic community is based on a population rather than individual effects, and is considered a target to which the benthic population as a whole can be stressed and still recover, in conjunction with the uncertainty associated with the predictive models used to develop these PRGs.

Thus, the 2016 FS used the same metric as all other RAOs in establishing an interim goal that was an order of magnitude greater than the PRGs. EPA's rational in the 2016 FS that this was reasonable since there is uncertainty based on the conservativeness of the SQVs used in the models (see BERA Section 6.2.5). Since benthic risk is made on a population basis, EPA's best professional judgement was that the entire affected community of benthos did not need to be addressed through capping and dredging and made an assumption that if 50 percent was addressed through active remediation of the highest contaminant concentrations, the other 50 percent would be addressed through MNR for the lower contaminant concentrations. Since benthic effects from contaminated sediment are due to survival, reproduction and growth (not just survival), this approach would also ensure that the entire population was not diminished through active remediation (capping and dredging will affect the survival – or kill - benthic organisms where it occurs) and some of the population affected through reproduction and growth could recover more slowly through MNR.

<u>LWG Dispute Issue 1c:</u>
EPA's conclusion that Alternatives B and D are not protective of the environment may also relate, at least in part, to EPA's decision to evaluate the performance of its alternatives based upon recalculated surface weighted average concentrations (SWACs) rather than those used in its August 2015 FS (used by EPA to estimate post-construction risks, detailed in EPA's Appendix J). The selection of a preferred alternative at a sediment CERCLA site is very sensitive to and dependent (i.e. "sensitively dependent") on the SWAC value of site; however, nothing in the June 2016 FS explains why EPA has changed its methodology for calculating SWACs between the August 2015 FS and the June 2016 FS, why EPA believes its current methodologies are superior to its prior methodologies, or even precisely what its current methodologies are.

The June 2016 FS appears to use these new SWACs to estimate pre- and post-construction risks for the alternatives. EPA presents an uncertainty analysis in Appendix I that evaluates different methods for estimating SWACs for pre-construction sediment surfaces. Using PCBs as an example, EPA presents SWAC estimates using four different methodologies that range between 79 and 205 micrograms per kilogram (μg/kg). (The natural neighbor method used for Remedial Action Level (RAL) curves in Section 3 estimates a site-wide SWAC of 92 μg/kg, which does not match any of the values in Appendix I). It is not clearly explained in the main text, but based on *tables presented in Appendix J (see Table J2.3-1a), it appears that EPA uses a high-end site-wide SWAC estimate (208 µg/kg, which is close to 205 µg/kg but not the same) to represent current site conditions for RAO 2 (i.e., pre-construction risks; identified as post-construction risks for Alternative A). This results in EPA presenting pre-construction risks that are completely inconsistent with risks identified in the approved BLRAs[13]. The risks estimated for Alternative A (no action) should be the same as baseline risks. EPA also assumes that postconstructed surfaces are "zero" (see ES-14). The net effect of these assumptions is that EPA poses technically unrealistic risk reduction estimates for all the alternatives. At the same time, EPA has not explained its use of the highest available estimate for pre-remediation SWACs and associated risks, which estimates are inconsistent with the BLRAs.*

13 The site-wide fish consumption risks estimated in the BHHRA (summarized in Section 1.2.5.1) are higher than those presented for Alternative A in Table J2.3-1a. However, the risks for Alternative A appear to be based on some estimate of an arithmetic mean concentrations whereas the BHHRA risks are based on 95% UCL or maximum concentrations. The average PCB concentration in the BHHRA based on actual tissue data was 160 ug/kg in bass and 2,500 ug/kg in carp, which includes a single outlier sample of 19,000 ug/kg (the average without the outlier is 353 ug/kg). The modeled tissue concentrations used for Alternative A are 352 ug/kg for bass and 820 ug/kg for carp, which are approximately 2 times higher than the measured tissue concentrations (excluding the single carp outlier). The river mile risks for Alternative A cannot be compared directly with the BHHRA because the risks for Alternative A are calculated based on one-third transects of a rolling river mile (both sides of the river and navigation channel) whereas the BHHRA risks were for an entire (bank-to-bank river mile). However, the risks for Alternative A are generally higher than those in the BHHRA (potentially due to spatial scale issues). In the BHHRA, risks at RM 11 were 1 x 10-3 and all other risks were less than 1 x 10-3. For Alternative A, EPA's FS indicates there are several segments with risks of 1 x 10-3 or higher.

EPA Position:

The 2015 draft FS and the 2016 FS both calculated SWACs on an SDU scale in the same manner. The 2015 draft FS did not calculate Site-wide SWACs; this was added to the 2016 FS in order to evaluate protectiveness to the RME based on Site-wide exposure consistent with the BHHRA. The Site-wide SWAC was developed consistent with the exposure of smaller range fish species rather than the methodology used by the LWG in their 2012 draft FS. Thus, EPA did not replace the evaluation, but supplemented it with additional analysis.

EPA evaluated the uncertainty associated with the calculated post-construction SWAC for each alternative as requested in the NRRB/CSTAG comments. The rationale for calculating Site-wide SWACs using alternative methodologies to reduce the bias introduced utilizing a non-random sample is explained in Appendix I of the 2016 FS. EPA is unclear to what Respondents' definition of "the SWAC value of site" is referring, as a SWAC is merely a spatially weighted concentration. As presented in Section 4.1.1 of the 2016 FS, the comparative analysis of the various alternatives is evaluated on several relevant spatial scales, including Site-wide and on a river mile, or SDU scale.

The 2016 FS, Appendix I, Section I.4, recommends that "with biased sampling prevalent at Portland Harbor it is necessary to spatially weight the data in order reduce bias in the estimated mean and to properly characterize uncertainty bounds." Therefore, as described in Section J2.1 of the 2016 FS, SWACs were calculated for each of the 27 geographic areas based on the recommendations in Appendix I and the 95 percent upper confidence limit on the mean was calculated for each RAO 2 COC. These UCLs were used as inputs to the FWM to calculate Site-wide average tissue concentration consistent with the final BHHRA. [Appendix I has been updated to include Figure I-9 depicting the 27 geographic areas where the SWACs were calculated for this analysis.] The pre- and post-construction concentrations were then used as the input into the food web model to estimate exposure concentrations to calculate pre-and post-construction risks, consistent with the process used in the BHHRA (the BHHRA calculated the 95 percent upper confidence limit on the mean of concentrations in fish tissue). Use of the food web model to estimate post-construction tissue concentrations is consistent with the process the LWG used in its 2012 draft FS. It is also appropriate to use for estimating risks for the no-action alternative, as the same metric is then used for the comparative analysis. Using the LWG-calculated "site-wide" SWAC of 92 µg/kg for PCBs results in an estimated average tissue concentration of 232 µg/kg, which equates to an estimated risk of 5×10^{-4} from PCBs alone, which is not consistent with and much lower than the 1×10^{-2} risk estimate for PCBs presented in Table 5-74 of the BHHRA. Since the efficacy of each alternative can only be evaluated through the use of predictive tools, and since the results of the BHHRA can't be replicated through use of the LWG-developed tools, comparing the baseline risks presented in the BHHRA to those estimated by the models would show an unrealistic decrease between the no action alternative and Alternative B.

Due to the lack of a defensible sediment transport model for the lower Willamette River, it was not possible to predict COC concentrations in remediated areas beyond t=0 with any degree of confidence. Assuming a clean residual or cap layer is sufficient for FS purposes and allows for use of a consistent metric of potential risk reduction in the comparative analysis of alternatives.

All risk-based PRGs presented in the 2016 FS utilize the exposure assumptions presented in the EPA-approved baseline risk assessments that are a part of the final RI report. Nonetheless, EPA is perplexed by the LWG's current concern that the 2016 FS might be "inconsistent with the approved baseline risk assessments," given that in their 2012 draft FS they abandoned the exposure assumptions from the risk assessments when developing remedial goals, and at that time they were totally comfortable using alternate assumptions. As stated in the 2012 FS (Appendix E, Section 1.1):

> "…alternate scientifically valid assumptions from those required by EPA could have been used in the BHHRA and in the development of remediation goals (RGs) for protection of human health."

<u>LWG Dispute Issue 1d:</u>
EPA's June 2016 FS improperly aggregates sediment data from 1997 through 2011 for the surface sediment characterization and is therefore significantly inaccurate. If EPA assumes a higher preremediation SWAC value that is inconsistent with the risk assessments and based on outdated data, then more aggressive clean up alternatives may plot closer to the inflection (i.e. "knee") of the utility curve. That inappropriate portrayal could lead a decision maker to select a remedy that requires more active remediation than is required to achieve cleanup goals. EPA's use of a SWAC that is inconsistent with the risk assessments exaggerates the benefits of the

larger alternatives and artificially drives remedy selection toward larger alternatives (e.g. E, F and I). If the SWAC value is set consistent with the approved risk assessments, the utility curve actually supports remedy selection toward Alternatives B, C and D.

<u>EPA's Position:</u>
The EPA 2016 FS uses the same "aggregated data" that the LWG used in their 2012 draft FS, except that data from the NW Natural and LSS early actions were also included. The LWG's 2012 draft FS, Appendix Ha (pp 26-27) states: "Because somewhat limited data were collected at the beginning of the model simulation period, and because the sediment data from that time did not fully characterize sediment levels uniformly throughout the site, the entire FS sediment dataset, which includes sediment data collected between 1997 and 2010 has been deemed representative of current conditions in the site." Further, p.46 of the LWG's 2012 draft FS, Appendix Ha states that "assessment of temporal changes in these data is difficult because this was not and objective of the historical sediment sampling programs … and as such, sediment data were generally examined qualitatively during model calibration." Consequently, if aggregating the data was significantly inaccurate or fatally flawed, so was the LWG's 2012 FS, which they claim incorporated "good science" and "provides an adequate basis for selecting a remedy." Further, the data collected for the Site was the same data used in the baseline risk assessment and therefore is appropriate to use to determine the expected risk reduction from implementation of each of the alternatives developed in the 2016 FS.

The baseline risk assessments use actual fish tissue data, not sediment SWACs, to determine risk. SWACs are a tool developed for the 2016 FS to compare alternatives to the No Action alternative and are not used nor discussed anywhere in the BERA or BHHRA. In the BHHRA, direct contact exposures to sediment were evaluated by aggregating data by exposure areas and calculating the 95 percent UCL on the mean; sediment data was not used to assess the fish consumption pathway. In the BERA, sediment data was also used to calculate a UCL on the mean of data within various spatial scales of receptors, rather than SWACs. The spatial scales used in the EPA's 2016 FS are consistent with those used in the risk assessments and the exposure assumptions are the same.

The RAL curves used to develop the remedial alternatives are not risk-based, although it is presumed that reductions in sediment concentrations will subsequently reduce risk since the exposure to contamination would be reduced by reducing the SWAC. The EPA RALs for PCBs, PAHs, and PeCDF are the same as the LWG's RALs for these contaminants in their 2012 FS and the curves are nearly identical (see Figures 3.4-1, 3.4-2, and 3.4-5, Tables 3.4-1, 3.4-2, and 3.4-3, and Appendix D5 of 2016 FS and Figures 4.3-1, Figure in Appendix Db p.89 of pdf, and Table 4.4-1 of the LWG's 2012 draft FS). The placement of the RALs on the curve are irrelevant to the selection of a remedy. How the alternatives perform based on the nine criteria specified in the NCP are the basis of remedy selection.

The FS fails to explain how the alternatives it has developed contribute to meaningful risk reduction in specific areas of the site. Protectiveness is a threshold criterion under CERCLA, but "protectiveness" does not support an EPA requirement for remedial action in the absence of identified unacceptable risk or failure to comply with an ARAR.14 The LWG has previously commented that EPA's August 2015 FS failed to follow the BLRAs or provide a clear description of risk management decisions, resulting in an FS that was inconsistent with the BLRAs in many *respects. Many of those comments remain relevant to the June 2016 FS and, in general, we will not repeat them here.15 However, several aspects of the June 2016 FS contain new or revised evaluations from the August 2015 draft that not only diverge without explanation from the approved risk assessments but lack any demonstration of their superiority to the analyses of the same and similar issues in EPA's August 2015 FS.16*

EPA Position:

The phrase "meaningful risk reduction" in the LWG's dispute is a subjective term and is nowhere defined in CERCLA, the NCP, EPA guidance or policy, nor by the LWG themselves. A discussion of risk reduction is provided in both the overall protection to human health and the environment and the long-term effectiveness discussions of each alternative in the 2016 FS. The discussion of long-term effectiveness discusses post construction risk for each alternative and compares it to the residual risk posed by the PRGs. The interim goals established in Section 4.1.3 of the 2016 FS were based on uncertainty in the PRGs and is used as a point at which EPA believes is acceptable risk for MNR to achieve PRGs in a reasonable time frame.

The 2016 FS is based on the baseline risk assessments and is consistent with the conclusions of those risk assessments. The 2016 FS is also consistent with the NCP and EPA guidance regarding development of PRGs for the Site.

> *Issue 17: 17. Risk Inconsistency – EPA's methods and results are often inconsistent with the BLRAs throughout the FS including Sections 2, 3, 4. This culminates in Section 4 with a residual risk assessment that departs significantly from the methods and findings of the BLRAs. The LWG has commented to EPA on numerous occasions (e.g., LWG 2014d, 2015a, 2015b) that EPA should include risk management steps in the FS consistent with guidance. These comments include that EPA should address only those potential risks for contaminants, media, and pathways that were clearly found to pose unacceptable risks in the BLRAs and that EPA should further focus on the subset of unacceptable risks that are required for selecting an effective and protective remedy using all of the FS criteria. Instead, EPA has departed from the BLRAs and applied virtually none of the risk management steps noted in guidance such as the 2005 sediment remediation guidance and EPA's 11 Risk Management Principles Memorandum for, "making scientifically sound and nationally consistent risk management decisions at contaminated sediment sites." The relevance of this guidance to risk management steps in the FS is reviewed in detail in Sections 10.1 and 10.2 of the 2012 draft FS. In summary, EPA guidance (2005a) discusses "Risk Management Principles and Remedial Approaches" and clearly describes that the cleanup should use a "risk-based framework"; "select site-specific, project-specific, and sediment specific risk management approaches that will achieve risk-based goals"; and "ensure that sediment cleanup levels are clearly tied to risk management goals" (p. 1 – 5).*
>
> *Specific issues related to EPA's lack of consistency with the BLRAs, residual risk assessments, and lack of risk management include:*
>
> *a. Per the LWG's 2014 Section 2 comments (LWG 2014d) and consistent with law, EPA guidance, and precedents from other sediment sites as detailed in past comments:*
>
> *i. RAOs, COCs, and PRGs should only be designated for contaminant exposure scenario pairs (ecological or human health receptors and pathways) for which the EPA-approved*

BLRAs identified potentially unacceptable risk from in-river media (e.g., not potential upland source media, and ARARs should not be used to develop PRGs for non-COCs).
ii. PRGs should be established and applied for these COCs consistent with risk assessment methods (e.g., spatial scales) and only where sufficient technically valid information exists to do so.
iii. The FS should focus on those COCs and PRGs that are technically practicable to achieve and for which acceptable risk levels can be reached through the sediment remedial action alternatives being evaluated in the FS.
iv. COCs and PRGs should only be established if reasonably conservative risk management approaches indicate that a contaminant is significantly contributing to risk and that evaluation of remedial alternatives with respect to a PRG for a particular COC/exposure pathway pairing is required in order to select a protective remedy.

EPA Position:

The Portland Harbor Site, as listed on the National Priorities List (NPL), includes an in-river and an upland portion. The 2016 FS focusses on the in-river portion of the Site and establishes RAOs that are protective for that portion of the Site. This includes protection of media such as surface water, pore water, and biota, in addition to sediments. It is clear that EPA may take a response action not only where there is a release, but where there is the potential threat of a release. 42 USC Section 9604(a). Further, the NCP and EPA guidance clearly state that other factors, such as ARARs, MCLGs and MCLs, and water quality criteria are to be used in developing PRGs and that risk-based levels are to be used where these PRGs are not available or risk cumulatively exceed 10^{-4}. Thus, exceedance of a water quality criterion or an MCLG/MCL can be a basis for action in addition to the findings of a risk assessment.

> CERCLA 104(a)(1) states "Whenever (A) any hazardous substance is released or there is a substantial threat of such a release into the environment, or (B) there is a re1ease or substantial threat of release into the environment of any pollutant or contaminant which may present an imminent and substantial danger to the public health or welfare, the President is authorized to act, consistent with the national contingency plan, to remove or arrange for the removal of, and provide for remedial action relating to such hazardous substance, pollutant, or contaminant at any time (including its removal from any contaminated natural resource), or take any other response measure consistent with the national contingency plan which the President deems necessary to protect the public health or welfare or the environment."
>
> 42 USC Section 9604(a)(1). The NCP [40 CFR Section 300.430(e)(2)] states that RAOs shall be developed considering (A) ARARs using factors of acceptable risk for systemic toxicants, cancer risks when ARARs not available, detection/quantitation limits, uncertainty, or other pertinent factors, (B) non-zero MCLGs, (C) MCLs, (D) when cumulative risk from ARARs is greater than 10^{-4}, use factors in (A), (E) water quality criteria, (F) ACLs, (G) levels protective of ESA T&E species.
>
> EPA policy *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* (OSWER Directive 9355.0-30, USEPA 1991) states that “For sites where the cumulative site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10 (-4), action generally is not warranted, but **may**

be warranted if a chemical specific standard that defines acceptable risk is violated or unless there are noncarcinogenic effects or an adverse environmental impact that warrants action."

EPA's 1991 policy also states that "Where the **cumulative carcinogenic site risk** to an individual based on **reasonable maximum exposure** for both current and future land use is less than 10 (-4) and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted unless there are adverse environmental impacts." (emphasis added) Both the BHHRA and BERA conclude that there is unacceptable risk at the Site that warrant EPA action (cumulative risk greater than 10-4 and HI or HQ greater than 1); thus, action is warranted at this Site.

Neither CERCLA, the NCP, nor EPA policy or guidance states that action may only be taken where risks are identified in the risk assessments. The NCP is clear that action may also be taken based on an exceedance of an MCLG/MCL or water quality criterion. Further, the risk assessments did not evaluate specific exposures in every area of the Site due to lack of data. The upland sources are not separate and distinct from the contamination in the river. The 2016 FS covers the in-river portion of the Site and thus the RAOs and PRGs must be developed to protect the media and pathways for which contamination is present. Since the RAOs and PRGs developed for this Site are based on the baseline risk assessments and ARARs, those areas of the Site which already achieve PRGs would not require action since the PRGs are already attained. EPA provides the basis for the establishment of PRGs for each RAO in Section 2 and Appendix B of the 2016 FS.

v. Consistent with EPA background guidance (EPA 2002), PRGs should not be set below reasonably achievable anthropogenic background levels (this includes the concept of "equilibrium" as explained in LWG 2014g). The LWG's Section 2 comments (LWG 2014d) detail how each of these concepts is consistent with remediation regulations and guidance.

EPA Position:
See EPA's position to LWG's dispute issue 1r.

b. Similarly, RALs for each COC should be applied consistent with the exposure and potentially unacceptable risk areas defined for that COC in the BLRAs (e.g., RALs should not be applied where the exposure pathway or unacceptable risks for those COCs do not currently exist). This is consistent with the "risk-based framework" required by guidance, as cited above. The issue of RAL consistency with the BLRAs is also noted in the Comment 3.

EPA Position:
As EPA has stated many times to the LWG, the RALs are not risk-based (with the exception of Alternative H, which uses the PRGs as RALs). The RALs are concentrations of focused COCs only, but are meant to cover all COCs posing risk to various receptors at various spatial scales. Thus, the RALs in combination, not individually, are meant to address all COCs, not just the specific focused COC. The RALs, therefore, apply everywhere within the Site where any PRGs are exceeded. In conducting the evaluation of the alternatives, EPA looked at how each

alternative met the PRGs. This was conducted for each RAO and was specific to the COCs, PRGs, and spatial scales relevant to that RAO. Both risk assessments show that PAHs contribute to unacceptable risk at the Site, not just from direct contact, but also as a dietary component.

Further, the EPA guidance does not require, but recommends 11 principles which principle 5 is “Use an iterative approach in a risk-based framework.” The 11 principles guidance describes this principle broadly to include approaches that incorporate testing of hypotheses and conclusions and foster re-evaluation as new information is gathered, any early or interim actions planned or implemented at the site that address threats from contaminated sediment, or whether the proposed sediment remedy will be part of a larger phased approach to the site as a whole. EPA discussed how this principle was addressed in the memo sent to the OSRTI Sediment Team on October 22, 2015, which is part of the OSRTI Sediment Team review concurrent with the NRRB review process. **[AR Doc # 100012830]**

As discussed in guidance, this principle is meant to provide an iterative approach as information becomes available. EPA has used this approach throughout the RI/FS process to screen out contaminants not detected in the RI, screen out contaminants not posing risk after completion of the baseline risk assessments, and further screened out some contaminants that were posing potential risk at the Site in the FS based on information presented in the 2016 FS, Table 2.2-2. [See also updated version attached to this dispute.] However, some questions remain and data needs to be collected for other contaminants.

As stated above, EPA will only require action where contaminants exceed PRGs in a particular media. If the PRGs are attained in a particular area of the Site, then action would not be required. The 11 principles are silent as to the use of RALs since these are not a required tool at sediment or other CERCLA Sites. The OSRTI Sediment Team did not provide any comments to the Region that there were deficiencies in the memo.

> *c. EPA presents a residual risk evaluation in Section 4 and indicates that the risks were calculated using methods consistent with the BLRAs. No details are provided on how the risk calculations where performed. Appendix H is entitled “Residual Risk Evaluation,” but this appendix only contains a brief description of how time-zero SWACs were estimated on a rolling river mile basis. Additional information on the exposure assumptions, exposure point concentrations (for both sediment and tissue), and toxicity values is needed to evaluate consistency with the BLRAs. EPA’s statement of consistency with BLRA methods is not enough to ensure that the methods are fully understandable or reproducible. Regardless, even based on the limited information presented, it is clear that EPA’s methods are not consistent with the BLRAs in at least several respects. Examples include:*
> *i. For human health sediment direct contact, time-zero SWACs were generated for shoreline areas (excluding the navigation channel) on a 1- river mile spatial scale, according to Appendix H. (However, the main text indicates instead that 0.5 river mile spatial scales were used. Also, Figure 4.2-1 suggests that EPA included the navigation channel in RAO 1 assessment, which would be incorrect.) Regardless, of how EPA actually did the assessment, sediment direct contact risks were evaluated in the BHHRA for shoreline half river miles, excluding the navigation channel.*

ii. For human health fish consumption risks, SWACs were generated on a 1-river mile basis longitudinally split into the two shoreline areas and the navigation channel. However, in the BHHRA risks were evaluated by whole river miles with no longitudinal splitting for recreational fish consumption. Further, it is unclear which fish consumption scenario is actually being presented in the residual risk figures. If the subsistence fisher scenario is being presented, this was evaluated on a Site-wide basis in the BHHRA (not by river mile). The text on page 4-6 indicates that EPA calculated tissue concentrations from the SWAC estimates, but no tissue concentrations are presented. The text also indicates that these estimated tissue concentrations were compared to the PRGs for RAO 2. The LWG indicated in the Section 2 comments (LWG 2014b, 2015a, 2015b) disagreement with several aspects of EPA's tissue PRG calculations (and that such tissue levels should be classified as PRGs at all) because EPA was not consistent with the BHHRA methods.
iii. The human health residual risks for Alternative A are higher than the maximum risks calculated in the BHHRA, which indicates there are inconsistencies (residual risks should not be higher than baseline). The highest non-cancer risk for a breastfeeding infant in the BHHRA was 10,000. The residual risk assessment indicates the highest non-cancer risk for a breastfeeding infant would be 210,000.
iv. There is a significant disconnect between the BHHRA and residual risks for RAO 2 for dioxins/furans. For a breastfeeding infant, the highest hazard quotients for dioxin/furan TEQ calculated in the BHHRA were 10 on a Site-wide basis (tribal fish consumption, whole body diet) and 10 on a river-mile basis (recreational RME consumption, RM 7). Figure 4.2- 4c(1) indicates that the HQ from HxCDF alone (not the entire TEQ) is more than 14,000 for Alternative A. For a child, the highest hazard quotients for dioxin/furan TEQ calculated in the BHHRA were also 10 on a Site-wide basis (tribal fish consumption, whole body diet) and 10 on a river-mile basis (recreational RME consumption, RM 7). Figure 4.2- 3f(1) shows a HQ greater than 30 for just HxCDF. The RfD has changed since the BHHRA was completed, but that does not account for the difference between the BHHRA and residual risks.

EPA Position:
EPA's residual risk evaluation is discussed in Appendix J of the 2016 FS. The approach used is consistent with the baseline risk assessments. RAO 1 was evaluated in shoreline areas only, not in the navigation channel, and evaluated on a half-river mile scale, which is consistent with the exposures in the BHHRA. RAO 2 was evaluated on both a Site-wide scale using PRGs based on a consumption rate of 142 g/day and one-river mile (including SDU) scale using PRGs based on a consumption rate of 49 g/day. While the exposure assumptions for RAO 2 are consistent with the risk assessment, EPA agrees that in the BHHRA risk was evaluated to the recreational fisher averaging tissue data across the river and the post-construction risk evaluated in the 2016 FS was on a river mile scale in river mile zones (east, navigation channel, west, and Swan Island Lagoon).

It is not uncommon and is acceptable to aggregate the data differently than evaluated in the baseline risk assessment in order to conduct a feasibility study that is evaluating the effect of cleanup of contamination in the river. The river mile data for the risk assessment were collected based on the home range of certain fish species, not the fishing pattern of the receptor. The risk assessment used river mile data for smallmouth bass composited across the river based on Round

1 data collected in 2002-2004. In 2005, ODFW conducted a radio tracking survey of several species and found that smallmouth bass are most commonly found in nearshore areas within a 1 km range of where they were released (ODFW 2005). Future sampling was then conducted for individual fish on either side of the river, but was aggregated in the same manner as the Round 1 data so that the data would still be comparable. Further, only smallmouth bass was used to assess risk on a river mile scale since other fish species were composited over a minimum of three miles. The 2016 FS calculated residual risk for all four fish species evaluated in the BHHRA based on a one river mile scale in the nearshore zone consistent with the preferred fish habitat and the assumptions of "recreational" fishers evaluated in the BHHRA. The calculated tissue concentrations are provided in Appendix J Table J1-2.

The 2016 FS was not attempting to replicate the BHHRA. There will be differences in the risks based on the methodology and data used. The BHHRA used fish data to assess the risk for RAO 2. The 2016 FS is using sediment data to predict a fish tissue concentration using the FWM and does not account for contaminant concentrations in water since the focus of the cleanup is the contamination in the sediment. Further, not all contaminants posing risk in this pathway were used in the residual risk assessment due to the inability to correlate sediment concentrations with tissue concentrations for some contaminants. The non-cancer risk for a breastfeeding infant of 10,000 in the BHHRA is on a Site-wide scale. The 2016 FS calculates that this risk would be 3,333. The non-cancer risk for a breastfeeding infant calculated in the 2016 FS only shows risk for this pathway greater than 10,000 at RM 7W for HxCDF, where the maximum risk is 253,347 (see Table J2.3-5c). The BHHRA showed risks for this pathway at RM 7 was 200 based predominantly on PCBs (Table 5-108). The disparity in these values is due to the aggregation of the data. As stated above, the fish data were averaged across the river and only included one of the four species used to assess risk in the risk assessment. Further, the risk assessment only uses smallmouth bass data to calculate risk on a river mile scale and the lack of data for lower trophic level fish which have higher tissue concentrations underestimates the risk and is acknowledged in the uncertainty section of the BHHRA (Section 6.1.1.10). The 2016 FS used the FWM, which allows evaluation of risk from consumption of all four species; thus, the calculated risks would not be directly comparable to the BHHRA. The 2016 FS also uses average sediment concentrations in river zones calculated on a one-river mile scale. The assumption then is that the fish are exposed to that concentration. Therefore, the analysis in the 2016 FS is based upon the representativeness of the data.

> *v. Continued exclusion of the site use factor from the BHHRA for BaPEq RAO 1 PRG (106 μg/kg) results in concluding that not even Alternative G will result in SWACs meeting the PRG at time zero in east and west river miles (per EPA's Table 4.2-1). However, if the BHHRA site use factor is accurately applied to this PRG (424 μg/kg), Alternative A appears to achieve RAO 1 in all East RMs (according to EPA's Figure 4.2-7b).*

EPA Position:

A factor of 25 percent (which corresponds to a site use factor of 4) was used for direct contact to sediment in the BHHRA to account for the time spent fishing in any single area within the Site. Therefore, the total risk to the fisher is based on any four areas of the Site. Thus, the maximum direct contact risk to the fisher from the BHHRA is 1 x 10^{-4} and HI=3. The PRGs developed in the 2016 FS are meant to be applied Site-wide and are established at a 1 x 10^{-6} risk level or HI=1, consistent with the NCP and ARARs. While the application of site-use factor may be appropriate assess the risk within a specific area, PRGs are intended to be applied uniformly to each area because actual activity patterns are not known. When potential exposure at more than a single area is considered likely, use of a site-use factor is no longer protective. Further, applying the use factor as suggested by the Respondent would still result in areas in the east river miles exceeding PRGs (see 2016 FS Table J2.2-1c).

vi. Residual risk figures should show and Section 4 should discuss human health risks compared to a 10-4 threshold in addition to the 10-6 threshold to fully evaluate the range of effectiveness. EPA's Section 2 presents PRGs calculated on both a 10-4 and 10-6 thresholds. EPA should evaluate alternatives in the entire acceptable risk range (10-4 to 10-6) against the FS evaluation, not just variations of RALs all targeted at 10-6 or lower risk.

EPA Position:

Residual risk is defined as the risk remaining once PRGs are achieved. Therefore, residual risk is calculated as the cumulative risk based on the selected PRGs. PRGs are calculated assuming a 1×10^{-6} risk or HQ of 1 and ARARs consistent with the NCP. The exceptions are where background concentration (based on EPA guidance on background) or analytical quantitation limits (per NCP) are greater than the risk-based PRGs or ARARs are not sufficiently protective. As discussed above, RALs are not established at risk levels but are established at levels greater than the PRGs. The 2016 FS does discuss the ability of each of the alternatives to achieve the 10^{-4} carcinogenic risk level as an interim target post construction to ensure that even if PRGs are not achieved, the residual risk is within EPA's acceptable risk range.

vii. For ecological sediment direct contact, SWACs were generated on a 0.2-mile basis with longitudinal splitting. This spatial scale may or may not be representative of the combined lines of evidence approach used in the BERA to assess benthic risks, given areas of benthic risk were defined for various sized clusters of sampling stations. Further, the hazard quotients presented in the figures appear to be generated by simply dividing the SWAC by the individual PRGs in Section 2, which are mostly based on generic literature Probable Effects Concentrations (PECs). The LWG has already commented on Section 2 (LWG 2014b, 2015a, 2015b) that use of the individual PECs is not consistent with the BERA determinations of benthic risks using multiple lines of evidence.

EPA Position:

The purpose of the FS is to evaluate cleanup options, not establish risk. The BERA used several lines of evidence to evaluate risks to benthic receptors present at the site and concluded that contamination posed unacceptable risk. Therefore, cleanup goals are developed to ensure that the identified risks at the Site are addressed. The evaluation of residual risk is based on the risks remaining once PRGs are achieved. In the 2016 FS, RAO 5 was changed from direct contact to benthic risk. The COCs are based on the BERA recommendation to base the remedy on the ecologically significant COCs (see Section 11 of the BERA). The PRGs for this RAO were based on the BERA SQVs as recommended by the NRRB/CSTAG. The PRGs are mapped in the 2016 FS against the benthic stations to ensure that the contaminant was contributing to benthic risk and then aggregated to compose the comprehensive benthic risk area (see 2016 FS, Appendix D11).

viii. For ecological bioaccumulation risks, SWACs were generated on a 1-river mile basis with longitudinal splitting. However, the receptors that appear to be used in the residual risk calculations were evaluated over various exposure spatial scales. For example, osprey egg assessment appears to be the receptor of choice for dioxin/furans and DDE, and osprey exposure was assessed in the BERA on a much larger spatial scale than 1 river mile. Thus, it is unclear how EPA's one spatial scale assessment can be consistent with all of these various BERA assessments. Further, the LWG has already commented for Section 2 that some of the receptors EPA focuses on for RAO 6 PRG development, and EPA presumably is focusing on for this residual risk assessment, are inappropriate and inconsistent with the BERA for reasons detailed in those past comments (LWG 2014b, 2015a, 2015b).

ix. The statement in Section 4.1.6.1 that "ecological hazard quotients are calculated using the estimated sediment concentrations and the riskbased PRGs for RAOs 5 and 6, consistent with the process used in the BERA" is misleading in its claim that RAO 5 and 6 PRGs are risk-based. The assertion that this EPA process used to calculate ecological hazard quotients is consistent with the BERA is obviously wrong because ecological hazard quotients that EPA reports in Section 4.2.1 for alternative A (no action) are much higher than BERA HQs. The residual risk assessment is also apparently inconsistent with the BERA in its use of "ecological hazard indices," although this is unclear because EPA has not defined the term.

<u>EPA Position:</u>
The 2016 FS was not attempting to replicate the BERA. There will be differences in the risks based on the methodology and data used. The BERA used biota data to assess the risk for RAOs 5 and 6 and used discrete river mile boundaries within the Site based on ecological exposures to aggregate the data. The 2016 FS is using sediment data to predict a tissue concentration using the FWM or BSAFs/BSARs and used incremental boundaries based on the same relevant exposure spatial scale as the BERA. Further, not all contaminants posing risk via this pathway were evaluated in the residual risk assessment due to the inability to correlate sediment concentrations with tissue concentrations. The disparity in HQs in the BERA and those in the residual risk estimate is due to the aggregation of the data and the models used to predict tissue concentrations. Further, the Respondents have not identified which ecological hazard quotients they believe are "much higher" than the BERA HQs. No "ecological hazard indices" are used in the 2016 FS.

x. The residual ecological risk assessment is inconsistent with the BERA in asserting that riverbank soil poses risk. No analysis is provided to back up this assertion and no analysis of riverbank soils (as defined in the RI) were assessed in the BERA.

<u>EPA Position:</u>
EPA agrees that the BERA did not assess risk from exposure to river bank soil in the BERA. The 2016 FS does not conduct a residual ecological risk assessment. The 2016 FS conducts an evaluation of residual risk under long-term effectiveness as required by the NCP and EPA

guidance. The river bank soil/sediment poses a risk of recontaminating the sediment, which is where exposure occurs. As stated on p. 2-8 of the 2016 FS:

> RAO 9 – River Banks: Reduce migration of COCs in river banks to sediment and surface water such that levels are acceptable in sediment and surface water for human health and ecological exposures. Reducing concentrations, exposure to, and the bioavailability of the COCs in river banks will reduce risk and recontamination at the Site. Ongoing source control efforts will provide additional risk and recontamination reduction.

> *xi. Despite EPA providing few method details, these aspects of EPA's residual risk methods can be shown to be inconsistent with the BLRAs. This suggests it is highly likely that other details of the methods, if they were known, would also be inconsistent with the BLRA methods.*

EPA Position:
The methodology used to evaluate residual risk is provided in Appendix J of the 2016 FS.

The fact that EPA finds the B and D RALs themselves (as well as a new "PTW" RAL) protective in certain areas of the site demonstrates that, as the LWG has previously commented,17 EPA's approach does not narrowly tailor required cleanup activities to actual site risks identified through the risk assessments. EPA has selected some cleanup criteria that may be applicable to certain locations (or facies) and applied them inappropriately in others. For example, the use of TPAH RALs within the navigation channel is technically inappropriate because the BLRAs did not identify potentially unacceptable risk from this class of chemicals (beyond the extent to which benthic risk identified in the BERA may correlate with PAHs) except in nearshore areas where direct contact or shellfish harvesting might potentially occur. EPA's application of E RALs in some but not all parts of SDU 3.5E results in the identification of a Sediment Management Area for PeCDD where the current SDU 3.5 SWAC already meets the most conservative PeCDD PRG of 0.0002 ppb for RAO2 (fish consumption on a river mile basis).18 In addition, the differential application of PAH RALs results in unjustified differential postconstruction risk. A larger remedial footprint results from the Alternative I using a 35,000 ug/kg TPAH RAL near outfall OF53A in SDU2E, whereas PAH-driven remedial actions in some other parts of the river have smaller footprints using a TPAH RAL of 69,000 ug/kg. The rationale for more extensive cleanup for PAH near OF53A and its net benefit is not explained.

EPA Position:
First, the LWG's issue appears to inflate the role of the RALs versus the PRGs. The RALs are not cleanup criteria as the LWG categorizes them but rather different removal (dredging or capping) concentration levels of the focused COCs for alternatives analysis of risk reduction. Since RALs are not risk-based, it is reasonable to evaluate specific SDU characteristics, particularly the driver COCs to determine what level of active cleanup would result in the most cost-effective risk reduction.

In conducting the detailed evaluation of alternatives on smaller spatial scales in 2015, EPA realized that some areas of the river could require less aggressive active cleanup (more ENR/MNR) while other areas required more aggressive active cleanup (more capping/dredging). Different RALs were selected in various areas of the Site for Alternative I due to the attainment of PRGs based on specific RAOs in some areas upon completion of construction at the applicable spatial scale of the PRG. The basis for Alternative I using the RALs from Alternative B plus PTW concentrations were that only Alternative B was needed to achieve the cumulative risk interim goal in SDU 6NAV for RAO 2 (see Table 4.2-1); however, all PTW needs to be addressed to ensure the mobile source material is reliably contained. The fact that EPA seeks to identify that some RALs would achieve a more protective post-construction risk reduction in some areas of the Site while others were necessary in other parts of the Site shows that EPA's approach does narrowly tailor the required cleanup activities to actual Site risks that the LWG argues should be done.

> *Issue 3. Remedial Action Levels – The LWG disagrees with EPA's dioxin/furan, TPAH, and DDx RALs for reasons discussed below. Also, the problematic absence of any evaluation of benthic risks as part of alternative development in Section 3 is discussed in Comment 3d.*
> *a. Dioxin/Furan RALs – The LWG does not agree that dioxin/furan RALs are necessary to define SMAs or select an effective remedy for the Site. EPA's Table 3.7-1 shows that the percent reduction in time-zero Surface-area Weighted Average Concentrations (SWACs) calculated by EPA for three dioxin congeners. The TCDD and PeCDD SWAC reductions for Alternative G are in the 60- to 70-percent range, which is a relatively low percent reduction as compared to the other RAL chemicals in the table. In contrast, the SWAC reduction for PeCDF starts at 89 percent for Alternative B and ends at 97 percent for Alternative G, which indicates that the range of RALs provides no meaningful differentiation in SWAC reduction for this congener. EPA has indicated (orally on August 27, 2015) that this is due to the paucity of data on detected dioxin/furan at the Site. However, the low data density and high non-detect frequency for the dioxin/furan dataset should be a reason to reconsider the value of dioxin/furan RALs, rather than a reason to explain the poor performance of such RALs. The insignificance of these SWAC reductions is more clearly illustrated by comparing the dioxin/furan SWACs achieved to EPA's own dioxin/furan PRGs by calculation of a SWAC exceedance factor—a factor above the PRG. This can be illustrated by comparing SWAC exceedance factors with and without EPA's proposed dioxin/furan RALs as shown in the tables below. The tables show that a RAL set that includes dioxin/furan RALs does not get the remedy meaningfully closer to acceptable risk levels as represented by EPA's PRGs. Details of this analysis can be provided. (EPA indicated orally on August 27, 2015, that EPA does not evaluate Site-wide SWACs, only SWACs on a rolling river mile basis. This is clearly incorrect given that the evaluation of each alternative in Section 4 starts with a presentation of Site-wide time-zero SWACs. ~~Also, EPA's own dioxin/furan PRGs are based on the osprey egg endpoint, which is assessed on a Site-wide spatial scale in the BERA.~~* [Sentence stricken per LWG request – see Attachment 1, 2015-10-08 FS Section 3 and 4 LWG Significant Issue Clarifications, 3rd bullet] *Thus, the Site-wide spatial scale is actually the most relevant scale for an analysis of dioxin/furan RALs.) For example, for PeCDD, Alternative F without dioxin/furan RALs achieves SWACs 310 times greater that EPA's PeCDD PRG, while adding the dioxin/furan RALs achieves SWACs for this same alternative that are still 256 times above the same PRG. (Also, conducting this evaluation on a rolling river mile basis would not change this conclusion. Specific rolling river miles would range much further above the PRG than this Site-wide assessment.) Similarly, the addition of the dioxin/furan RALs only slightly reduces the SWAC*

exceedance factors for PeCDF and TCDD across all alternatives, and none of the alternatives are estimated to achieve SWACs that are below those PRGs.

5 Per EPA's website (http://www.epa.gov/superfund/health/contaminants/dioxin/dioxinsoil.html): "For example, the PRG calculated using the new RfD of 0.7 pg/kg-day (picogram per kilogram-day) and EPA non-adjusted exposure factors would be 50 parts per trillion (ppt) toxicity equivalence (TEQ) for residential soil and 664 ppt TEQ for commercial/industrial soil."

SWAC Exceedance Factor above the PRGs – without EPA's Dioxin/Furan RALs Alternative PeCDD PeCDF TCDD

Alternative	PeCDD	PeCDF	TCDD
B	409	2.3	9.4
C	407	2.3	9.4
D	401	2.3	9.3
E	360	1.8	6.7
F	310	1.7	6.0

SWAC Exceedance Factor above the PRGs – with EPA's Dioxin/Furan RALs Alternative PeCDD PeCDF TCDD

Alternative	PeCDD	PeCDF	TCDD
B	354	2.1	6.6
C	341	2.1	6.5
D	314	2.0	6.3
E	293	1.4	5.8
F	256	1.3	5.5

Also, for all of the dioxin/furan RALs EPA uses the exact same RAL numeric value to represent more than one alternative. For example, for TCDD, EPA proposes using the same RAL value of 0.002 µg/kg for Alternatives B, C, and D and the same RAL value of 0.0006 µg/kg for Alternative E, F, and G. This approach substantially constrains the alternatives from providing any meaningful changes in SWAC reduction or the SMA shapes and areas defined. Essentially, EPA is only providing three alternatives with regards to dioxin/furans. This appears to conflict with EPA's approach where the RALs (as opposed to technology assignments discussed in Comment 1) are the only real difference among alternatives. Thus, in the case of dioxin/furans, the alternatives have no variation in technology assignments and very little meaningful variation in term of RALs as well.

EPA Position:

Section 5.2.3.1 of the RI Report states that the PCDD/F data set is limited (about one-fifth the size of other contaminant data sets) and cautions in making conclusions regarding the spatial patterns of the composition of total PCDD/Fs in sediment. Thus, EPA acknowledges there are limitations in how the RALs perform based on the current data. Based on existing data and the risk assessments, dioxins/furans pose the second greatest risk within the site to both human and ecological receptors. As such, the risks from this contaminant group must be addressed at the Site. The RALs for other focused COCs do not sufficiently cover the dioxins/furans posing risk from exposure to sediment. However, the dioxin/furan sediment data collected by the Respondents is sparse and large areas of the Site were not sampled for dioxin/furans; thus, not characterized. The lack of data is not a basis for excluding these contaminants from the cleanup options presented in the 2016 FS. EPA explains in Section 3.4.1.2 of the 2016 FS the basis for some of the dioxin/furan RALs being the same in more than one alternative. Furthermore, the alternatives are developed as a combination of RALs, not individual RALs, and while the alternatives may not differ with respect to some of the dioxins/furans, they do differ with respect to other contaminants.

The 2016 FS only applies RALs where those concentrations are exceeded in sediment based on the RI data. As EPA has stated above, RALs are applied in combination to develop SMAs that cover all COCs in sediment greater than PRGs. EPA's applications of the E RALs in SDU 3.5E results in an estimated 1,2,3,7,8-PeCDD sediment concentration of 0.000125 μg/kg (see Table J2.3-7 in the 2016 FS). The 1,2,3,7,8-PeCDD PRG for RAO 2 is 0.0002 μg/kg (see 2016 FS Table 2.2-1). While the 1,2,3,7,8-PeCDD PRG is achieved post-construction for this alternative, other COCs are not. As shown in the 2016 FS, Table J2.3-8b, the residual risk for Alternative E in SDU 3.5E is 1×10^{-4}.

The 2016 FS developed dioxin/furan PRGs based on the relevant spatial scale for the RAO. Some of these are Site-wide, while others are at smaller spatial scales. However, in selecting PRGs for each of the RAOs, the most protective PRG is selected and applied at all relevant spatial scales.

> *b. TPAH RALs – Per discussions at the 2014 FS technical meetings, the LWG disagrees that TPAH RALs should be used instead of cPAH RALs (expressed as BaPEq). BaPEq is consistent with the methods and results of the BHHRA, which were assessed in terms of total cancer risk from cPAHs on a BaPEq basis. Following the risk-based approach called for in the guidance,6 RALs should be consistent with the methods and findings of the BLRAs to ensure that sediment remedies are "risk-based" (i.e., result in effective risk reduction). Further, EPA's latest Section 2 human health PAH PRGs are all expressed as BaPEq. Therefore, use of BaPEq RALs allows for a direct comparison on a consistent basis between the RALs and the PRGs, whereas TPAH RALs do not. Further, the use of BaPEq RALs for human health and Comprehensive Benthic Risk Areas (CBRAs)7 for ecological risks addresses all of the PAH-related potentially unacceptable risks found in the BLRAs. Also, the BaPEq RALs should only be applied to human health exposure areas outside the navigation channel consistent with the risk-based approach called for in the guidance. The cPAH risks related to sediment direct contact and shellfish consumption exposures occur only outside the navigation channel (along the shoreline), and as a result, BaPEq RALs associated with these potential risks should be applied in these areas only. The only remaining human health potential unacceptable risk identified in the BHHRA was for the fish consumption scenario, which was determined using cPAH concentration data in fish tissue. There is no valid relationship between cPAH fish tissue and sediment concentrations at the Site, or any other sediments site, due to the rapid metabolism of PAHs by vertebrate fish (see LWG 2014d, 2015a, 2015b for additional details and references). Carcinogenic PAHs represent less than 1% of the cumulative risks to people eating fish and are, therefore, not a good reason to expand the remedy by hundreds of millions of dollars on the basis of a technically inappropriate PRG, given*

that there is no reasonable expectation that such an expansion could have any meaningful impact at all on the overall fish consumption risk. Because the BaPEq RALs can only be linked to effective risk reduction along the shoreline (using the BHHRA findings and the resulting appropriate PRGs for sediment direct contact and shellfish consumption), these RALs should only be applied along the shoreline outside of the navigation channel.

6 EPA guidance (2005a) discusses "Risk Management Principles and Remedial Approaches" and clearly describes that the cleanup should use a "risk-based framework"; "select site-specific, project-specific, and sediment specific risk management approaches that will achieve risk-based goals"; and "ensure that sediment cleanup levels are clearly tied to risk management goals" (p. 1 – 5).
7 See Comment 15 for more details on the LWG's position regarding benthic risk and EPA's removal of the CBRAs from the revised FS.

EPA Position:
Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different individual PAH compounds (ATSDR). Total PAHs were evaluated in the BERA and include the combination of 17 individual PAH compounds. The conclusions of the BERA was that total PAHs were ecologically significant at the Site (see BERA Table 11-5). There is nothing in the BERA that states that there is no risk from PAHs in the navigation channel. There is also nothing in the BERA that states that there is no exposure or risk to aquatic organisms in the navigation channel. To the contrary, the BERA identifies PAHs as a contaminant contributing to risk in almost every species evaluated in the BERA. The BHHRA only evaluated those individual PAHs which are cancer causing (16 individual PAH compounds). The BHHRA concludes that PAHs contribute to risk from consumption of fish in addition to risks from consuming shellfish and direct contact. The RALs are not risk based and are applied to all areas of the Site where they are exceeded. The evaluation of the alternatives evaluates those contaminants that are posing risk for each RAO by comparing the appropriate post construction contaminant concentrations to the PRGs for each RAO at the appropriate spatial scale in the Site. Residual risk and post construction risk for RAO 1 was not evaluated in the navigation channel since EPA agrees that this RAO is not applicable to that area of the Site; however, all other RAOs are and were evaluated in the navigation channel. RAOs 1 and 2 evaluate post construction cPAH concentrations to cPAH PRGs while RAO 6 evaluates post construction total PAH concentrations to total PAH PRGs. Additionally, there is no difference between the cPAH RALs developed by the LWG in the 2012 FS and the total PAH RALs used by EPA in the 2016 FS. EPA simply took the cPAH RALs developed by the LWG and converted them to total PAH using the regression analysis of the cPAHs at the site to total PAHs in sample pairs (see 2016 FS, Appendix D5).

The application of RALs in various parts of the river will result in differential post construction concentrations risks based on the remaining concentrations of different COCs in the area being evaluated. The basis for selecting E RALs for SDU 2E in Alternative I is based on the resulting residual risk from all COCs, not just PAHs. PCBs is the driving the risk in this area of the Site. As stated above, the RALs act in combination, not independently, in development of the alternatives. EPA is applying different alternatives (which are combinations of RALs) for Alternative I, not different individual RALs, in various parts of the river. The only area where D

RALs was selected in Alternative I is SDU 6W. This area has a much greater SMA footprint from PAHs that SDU 2E since the PAHs are driving the risk in this area of the Site.

c. DDx RALs – Although the LWG agrees with the use of DDx RALs as a general concept8 instead of individual DDD, DDE, and DDT RALs in the 2012 draft FS, the LWG disagrees with the upper end of the RAL curve selected by EPA. There is little differentiation in the areas mapped using EPA's B, C, and D RALs. For example, according to EPA's Table 3.3-4, within the RM 7W area, the acreages defined by EPA's DDx RALs for Alternatives B, C, and D are 10, 12, and 15 acres, respectively. EPA further indicates these RALs achieve Site-wide SWACs of 21, 20, and 19 ppb, respectively. Thus, this range of RALs represents virtually no substantial difference in areas remediated or risk reduction likely achieved. Instead, EPA should use DDx RALs of 8000, 1000, and 500 µg/kg for Alternatives B, C, and D, respectively. This RAL set would provide a wider differentiation between the active remediation acres and resulting SWACs achieved across these three alternatives. In addition, the LWG has the following specific concerns about EPA's DDx RAL analysis:

i. Table 3.3-4 presents an inappropriate comparison of DDx RALs to a SWAC derived for a localized area of RM 6.6 to 7.8. EPA does not explain the basis for evaluating DDx across this area rather than an area that is consistent with the spatial scale evaluated in the BLRAs most related to appropriately calculated DDx PRGs. As noted above, RALs should be developed consistent with the BLRAs to be consistent with FS guidance.

ii. The LWG's original position in 2011 was to use DDE RALs as a surrogate for DDD and DDT (and as a result, for total DDx). However, EPA expressed concerns in 2011 and again in 2014 FS technical discussions that the DDE RALs, by themselves, might not sufficiently bound areas of elevated DDD and DDT sediment concentrations. No supporting technical basis was provided by EPA for this concern, and none is provided in Sections 3 and 4. The determination of bounding COCs for RAL development is an evaluation that requires best professional judgment that must be clearly explained. In addition, the 2012 LWG draft FS indicates that potentially unacceptable risks associated with DDx are based only on the most conservative fish consumption pathway and are localized to RM 7, where DDx contributes only 3% of the cumulative potentially unacceptable risks. Given that EPA does not explain the reasons for the conversion from separate RALs to one combined set of DDx RALs, the LWG's proposal above may not fully resolve the LWG's concerns regarding EPA's DDx RAL approach.

d. Comprehensive Benthic Risk Areas – EPA makes no mention of the CBRAs in the FS Section 3 text or how those risks are addressed through the proposed RALs and SMAs. See Comments 15 and 17 for more information regarding the LWG's position on benthic risk and need for consistency with the risk assessments.

8 However, the LWG does not necessarily agree with how EPA made the conversion from separate RALs to a combined DDx RAL or with the EPA's DDx RAL values as noted further below in this comment.

EPA Position:

While the Respondents did not disagree with the use of DDx RALs, they are disputing the RALs used by EPA for Alternatives B, C, and D. EPA used the following RALs in the 2016 FS:

Table 3.4-4
DDx RALs with Resulting SWACs and Acres
Portland Harbor Superfund Site
Portland, Oregon

DDx					
		RM7W		Site Wide	
Alternative	RAL (µg/kg)	SWAC (µg/kg)	Acres	SWAC (µg/kg)	Acres
B	650	100	10	22	11
C	550	85	12	21	13
D	450	65	15	20	16
E	300	37	20	18	22
F	160	22	25	16	33
G	40	10	35	11	114
H	6.1	6	64	6	1,130

The Respondents argue that EPA should use DDx RALs of 8,000, 1,000, and 500 µg/kg for Alternatives B, C, and D, respectively, and that this RAL set would provide a wider differentiation between the active remediation acres and resulting SWACs achieved across these three alternatives. The current Site-wide SWAC for DDx is 52 µg/kg and the current RM 7W SWAC is 640 µg/kg. The suggested RALs from the Respondent would equate to the following SWACs and acres remediate:

Site-wide SWAC:

Alt	Rals	postSWAC	Acres
B	8000	38.72	1.22
C	5000	34.74	1.95
D	500	20.42	14.05

RM7W SWAC:

Alt	Rals	postSWAC	Acres
B	8000	373.9	1.22
C	5000	306.3	1.95
D	500	74.5	13.39

As the above analysis demonstrates, this contaminant is very localized in one area of the Site – RM 7W, as shown by the acres addressed by RALs. Table 3.4-4 and Figure 4.3-12 in the 2016 FS also shows this. Further, the LWG acknowledge this in their 2012 FS [**AR Doc # 706171**, Section 4.1, p. 4-4]:

> Sum-DDE, particularly due to relatively localized potentially unacceptable risks near RM 7 to human health via fish consumptions (either smallmouth bass or large home range fish).
>
> Sum-DDD due to relatively localized potentially unacceptable risks near RM 7.
>
> Sum-DDT due to relatively localized potentially unacceptable risks near RM 7.

The B and C RALs only address contamination at RM 7W (as shown by the acreage Site-wide being the same as those at 7W). Very little area (1-2 acres) would be addressed using these RALs and the Respondents do not provide a basis for why selecting RALs at these concentrations would be meaningful in reaching the PRG of 6.1 μg/kg. Based on the uncertainty evaluation in the 2016 FS, Appendix I, the RALs suggested by Respondents for Alternatives B and C would not be statistically discernable from the no action alternative based on the variability of the data. Therefore, there would not be any "meaningful risk reduction" through selection of these RALs. Further, RALs are developed to address contaminant concentrations in the Site and are not based on risk – only PRGs are based on risk. However, the evaluation of the application of the RALs in reducing risk is conducted on spatial scales consistent with the baseline risk assessments.

EPA has had several discussions with the LWG and have provided comments regarding the use of DDE RALs dating back to June 2011. **[AR Doc # 100015899 and 100007242]** In all the discussions and comments provided by EPA between 2001 and 2015, EPA did not merely raise concerns but also provided technical information to support EPA's determination that DDE RALs do not sufficiently address all risk from DDD, DDE, and DDT. EPA also provided a document presenting maps of RAL options to the LWG as early as July 27, 2011. **[AR Doc # 100033475, 663228, 663260]** Further, on August 11, 2011, EPA directed the LWG to use DDx RALs in the 2012 draft FS and the LWG did not dispute this direction at that time. **[AR Doc # 663242 and 663285]** The LWG never provided any information on why using DDE RALs as a surrogate for DDD and DDT is appropriate or reasonable. Both the BHHRA and BERA address risk to receptors as DDx; only the exposure to surface water used DDE, DDD, and DDT and bird egg assessments used DDE. The basis for using DDx is that it is directly comparable to the risks in the river and the only reason EPA developed RALs individually for DDD, DDE, and DDT were so the LWG could model them in their fate and transport model. The FS is a technical document that has the sole purpose of developing and evaluating alternatives and is not a document that is used to discuss the differences between the EPA and LWG FS documents. EPA has had many discussion with the LWG over issues with their 2012 FS and have incorporated EPA's final determination on those in the 2016 FS.

> *e. EPA indicates in Section 3 that the RALs were selected using RAL curves and considering the zone of maximum incremental SWAC reduction, the zone of marginal incremental SWAC reduction, the knee of the curve, and spatial distribution of the RAL points on the curve. The LWG generally agrees with these RAL selection criteria, which are similar to those stated in the 2012 draft FS. However, a cursory review of the RAL curves presented indicates a wide difference in the RAL points chosen along these curves across the various chemicals. Considering the EPA stated selection criteria either individually or together, there is no discernable consistency in the RAL points selected on the curve for one chemical to the points on the curve selected for another chemical. Thus, the stated selection criteria do not appear to be followed.*

<u>EPA Position:</u>
In the 2016 FS, there is no selection criteria for the RALs (refer to Appendix D1), as stated by the Respondents. EPA notes that there are points on the curves that are considered (the zone of maximum incremental SWAC reduction, the zone of marginal incremental SWAC reduction, the knee of the curve, and spatial distribution of the RAL points on the curve) but does not use these

are rigorous selection criteria. The PCB and PAH RALs were selected by the LWG and carried forward into the 2016 FS. The DDx RALs are based on localized contamination and, therefore, the selection of RALs had to be carefully selected to ensure a broad range of footprints could be evaluated. The 2016 FS clearly describes the methodology for selecting the dioxin/furan RALs and why those differed from selection of the other RALs.

> *Issue 15. Inappropriate Benthic Risk Analysis – EPA does not mention benthic community risks in the Section 3 RAL, SDU, or SMA development text (as noted in Comment 3). EPA must develop and evaluate alternatives that fully consider benthic risks using methods that are consistent with the BERA. Although EPA conducts an extensive SDU analysis to assess whether the selected RALs bound other risk pathways, EPA does not discuss the extent to which these RALs are expected to bound and address benthic community risks. In contrast, the 2012 draft FS included a detailed evaluation of and determination of benthic risk SMAs using the CBRA approach, as required by EPA at the time.*
>
> *Then in Section 4, EPA evaluates the alternatives for their ability to adequately address benthic community risks. EPA concludes that all the alternatives do not address through active remediation a "substantial" portion of the benthic community risks. For example, EPA states for Alternative G, "There are a substantial number of locations where unacceptable benthic risk (identified via bioassays or predicted via the Logistic Regression Model [LRM]) are not encompassed by the areas of construction as shown on Figure 4.2-11." EPA states that the remaining benthic risks will be addressed through MNR. While it is reasonable to address low-level risks through MNR (including benthic risks), EPA has constructed alternatives that ignore benthic risk and then demerits those same alternatives in the effectiveness evaluation for failing to adequately address benthic risks.*
>
> *EPA's benthic risk approach is particularly inconsistent given that EPA made multiple changes to the RALs between the draft and revised FS because EPA deemed the 2012 draft FS RALs for PAHs, DDE, and dioxin/furans as "not protective." This decision resulted in extensive work to recalculate all the SMAs and alternative quantities and costs. EPA does not attempt to explain in Section 4 whether EPA could have avoided all of this rework and instead similarly decided that MNR would address relatively low-level risks for PAHs, DDx, and dioxin/furans that EPA deemed were not directly addressed by the 2012 draft FS RALs. There are some important additional technical issues with EPA's benthic risk approach as follows:*
>
>> *a. EPA's method for defining benthic risks requires additional explanation. EPA provides one figure series (Figure 4.2-11 and Figures 4.2-14 through 17) and two statements regarding the methods used: 1) "Identified via bioassays or predicted via the LRM"; and 2) "Additionally, benthic risk is evaluated by determining the percentage of measured or predicted benthic toxicity points addressed by the construction of the alternative." The term "toxicity points" is new and not defined. Consequently, these results are not reproducible and the subsequent, related conclusions appear unsupported.*

b. From examination of the cited figures, it appears that EPA used any instance of a Level 2 or Level 3 bioassay hit and any exceedance of the LRM benthic screening levels to determine that "benthic risk" was present at any given sampling station. The BERA is clear that individual benthic toxicity lines of evidence are insufficient to fully characterize benthic risks at the Site.

14 EPA guidance states:
*"As a general policy and in order to operate a unified Superfund program, EPA generally uses the results of the baseline risk assessment to establish the basis for taking a remedial action using either Section 104 or 106 authority. *** If the baseline risk assessment and the comparison of exposure concentrations to chemical-specific standards indicates that there is no unacceptable risk to human health or the environment and that no remedial action is warranted, then the CERCLA Section 121 cleanup standards for selection of a Superfund remedy, including the requirement to meet applicable or relevant and appropriate requirements (ARARs), are not triggered."*
In other words, where the baseline risk assessment concludes that a human or ecological receptor will not be exposed to potentially unacceptable risk by a contaminant present in a given media, there is no basis for taking remedial action. Where no remedial action is warranted, development or refinement of preliminary or final remediation goals is unnecessary. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions, p.3 (OSWER Directive 9355.0-30, April 22, 1991).
15 See, LWG, List of Significant Issues with EPA's Revised FS Sections 3 and 4 (September 8, 2015), Issue 17 at pp. 44-48. (included within Attachment 1). The LWG's comments on the August 2015 FS are included as Attachment 1 and incorporated by reference.
16 For example, the uncertainty analysis in Appendix I concludes that Alternative B is statistically indistinguishable from the no action alternative. This disagrees with figures in Section 4.2 that shows that the biggest drop in HQ and cancer risk is from the no action alternative to Alternative B as compared to the other alternatives.
17 See, LWG, List of Significant Issues with EPA's Revised FS Sections 3 and 4 (September 8, 2015), Issue 3 at pp. 9-13 (included within Attachment 1).
18 See, e.g., Table 4.2-1 of EPA's August 2015 FS.

EPA Position:
EPA developed a comprehensive benthic risk area based on the PRGs for RAO 5 in the 2016 FS. This area is presented in Figure 4.4-1 and development of it is presented in Appendix D11. Section 3 of the 2016 FS discusses the development of the alternatives; evaluation of the alternatives, including how risks are addressed through the proposed RALs and SMAs, is discussed in Section 4. EPA did not use benthic risk as a basis for development of alternatives as EPA did not develop RALs for all other COCs. The focused COCs were chosen based on their coverage of other COCs, including those for RAO 5. None of the alternatives address all the risks at the Site through construction, with the exception of Alternative H. In the evaluation of alternatives in Section 4, EPA discusses those risks that are not addressed by the construction of the alternatives so that it is clear how much risk was addressed and how much remains to be addressed through MNR. EPA does not "demerit" or characterize this evaluation as a "failure" for any of the alternatives.

LWG Dispute Issue 1e:

Other EPA revisions and changes between the August 2015 and June 2016 drafts of the FS that diverge without explanation from the RI and BLRA (and from each other) include:

On page 1-24, EPA identifies 66 COCs posing unacceptable ecological risks and determines that 20 of these COCs "pose risks ecologically high enough to consider development of a remedial action." EPA presents no details of how this risk management decision was made and or how it is consistent with the Baseline Ecological Risk Assessment (BERA).

EPA Position:

The BERA, in Section 11.4, presents Contaminants of Ecological Significance and concludes:

> "All contaminants posing potentially unacceptable risk at the end of the BERA were recommended to be carried forward to the FS. Those classified as posing ecologically significant risk in Table 11-5 are recommended for consideration in developing and evaluating remedial action alternatives in the 2016 FS based on the pathways and factors considered in the BERA. Contaminants posing potentially unacceptable risk at the end of the BERA that are not listed in Table 11-5 are recommended for comparison with pro[t]ected post-remedial action conditions to confirm that alternatives developed for the ecologically significant contaminants would be protective for risks of low ecological significance."

Therefore, this risk management decision was carried forward from the recommendation made in the BERA and is therefore consistent with the BERA. EPA made risk management decisions in Section 2 of the 2016 FS as to which COCs would be evaluated further in the 2016 FS (see Table 2.2-2).

LWG Dispute Issue 1f:

The 2,4' and 4,4'-DDD, -DDE, -DDT (DDx) PRG for RAO 6 decreased substantially and is now based on sculpin tissue residue instead of sandpiper.

EPA Position:

The DDx PRG for RAO 6 is based on the sculpin tissue residue (760 μg/kg) rather than the spotted sandpiper (2,849 μg/kg). As discussed by EPA in Section 2.2.2.2 of the 2016 FS (p. 2-11), the lowest PRGs was selected for each COC to ensure protection of all species.

LWG Dispute Issue 1g:

EPA's proposed background values are still based on inappropriately derived upstream bedded sediment statistics that are unlikely to represent achievable cleanup levels for the site as they do not account for anthropogenic influences, which are known in the scientific literature to exist throughout the Willamette basin.19 The FS also does not present background concentrations for surface water and does not present sediment background concentrations for all chemicals with sediment Preliminary Remediation Goals (PRGs).

EPA Position:

Background calculations for sediment were developed as part of the Remedial Investigation Report, not the Feasibility Study, except for dioxins/furans. Under the RI/FS AOC, the LWG formally disputed EPA's directions on the statistical approach for calculating background. On March 24, 2015, EPA's Director of the Environmental Cleanup Office made a final decision on the methodology and statistical approach for calculating background and directed the LWG to calculate background for 23 contaminants using the methodology. **[AR Doc # 500011627]** We understand the LWG may continue to disagree with the methodology, but that issue is no longer subject to dispute under the RI/FS AOC. Since the RI report calculated background for dioxins/furans as total PCDD/Fs and TEQ and EPA was using dioxin/furan congeners for the analysis in the 2016 FS (see 2016 FS Appendix B2), EPA calculated the background concentrations for the congeners of concern to: (1) develop PRGs, and (2) conduct the evaluation of the alternatives in the 2016 FS (see Appendix B of the 2016 FS). EPA used the same methodology to calculate background concentrations for dioxin/furan congeners of concern as was used in the RI and consistent with the EPA Director's final dispute decision.

Neither the RI nor the 2016 FS presented background concentrations for all COCs in sediment because the RI report concluded that there were insufficient detections to determine background concentrations for 2,3,7,8-TCDD eq, aldrin, dieldrin, DDT, Lindane, and TBT. The exception is TPH-diesel in which a background concentration was calculated in the RI Report, Appendix H, but was inadvertently omitted from Table 2.2-9 in the 2016 FS. The background concentration is 61 mg/kg, which would not change the selection of the PRG, which is 91 mg/kg, since the risk-based number is greater than background.

EPA did not present background concentrations for surface water in the 2016 FS since there was insufficient data to statistically compute a background concentration (i.e., there was only one year where 3 seasonal data points were collected). Further, since surface water PRGs are based on ARARs, EPA would need to waive the ARAR, which means that significant information would be needed to show that achieving the ARAR is technically impracticable.

LWG Dispute Issue 1h:

Sediment PRGs for RAO2 and RAO6 as well as riverbank PRGs for RAO9 for the five PCDD/Fs congeners are now all based on background concentrations. Background PCDD/F concentrations for individual congeners are presented in Appendix B, Table B2-4 of EPA's FS. The background values, however, are based on limited and poor quality data (with elevated detection limits) and involve taking the 95 UCL of detection limits for congener datasets based on all non-detects. In fact, only one congener has sufficient data (1,2,3,4,7,8-HxCDF) to calculate a background value and even that is limited (13 of 31 samples were non-detects). Thus, most of the background "values" are based on a 95% UCL of the detection limits rather than actual detections of contaminants. The background values are skewed quite low compared to those calculated for other urban watersheds and are of similar uncertain statistical validity.

EPA Position:

The LWG now states that its upstream dioxin data is limited and of poor quality, yet when it submitted its draft RI report it represented that the data was sufficient and submitted background values for EPA to approve. LWG presented background statistics for 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8-PeCDD, 2,3,4,7,8-PeCDF, 2,3,7,8-TDD, and 2,3,7,8-TCF in its 2011 draft RI report, essential using the same limited and poor quality data with elevated detection limits. Of these, the frequency of detection is greater than 50 percent for only 1,2,3,6,7,8-HxCDD, and is as low as 4 percent for 2,3,7,8-TCDF. Yet the LWG calculated a 95 percent upper predictive limit and a 95 percent upper confidence limit on the mean of the data for each dioxin/furan.

EPA determined that it was not appropriate to calculate upper confidence limits (UCLs) on the mean and upper predictive limits (UPLs) on data with such low frequency of detection, thus, background presented in the 2016 FS for these analytes was established as the 95th percentile of the detection limits. Because the background data set represented “real life” data, EPA chose to establish background based on an upper limit of achievable detection limits.

LWG Dispute Issue 1i:

And while EPA’s explanation of its development of its preferred Alternative I appropriately recognizes that Portland Harbor is a large and complex site where location-specific issues are important, EPA's June 2016 FS continues not to resolve a number of the LWG’s prior questions about how EPA’s alternatives contribute to meaningful risk reduction at the site consistent with CERCLA and the NCP:

EPA’s calculation of PAH PRGs (and use of such PRGs for calculating post-construction risk) for minor or non-existent PAH fish consumption risk are not explained and not supported by the risk assessments.

EPA Position:

According to information presented in the final BHHRA, fish consumption risks solely from PAHs are 8×10^{-6} for tribal consumers (assuming a site-wide averaged concentration and a 175 g/day consumption rate) and 2×10^{-5} at RM 5 assuming a consumption rate of 49 g/day. While these do not approach the 1×10^{-2} site-wide risk estimates, EPA, unlike the LWG, does not consider these risk estimates “minor or non-existent.”

The LWG has long maintained such risks are impossible, noting in the Bioaccumulation Modeling Report (2009 and 2015) that “fish metabolize PAHs.” LWG further claims (p.163 of Attachment 1 to the dispute statement) that “The LWG has previously pointed out to EPA that there is no relationship between concentrations of BaP in sediment and vertebrate fish at the Site or anywhere else, given that it is well documented that fish metabolize PAHs to a greater extent than invertebrates, and that “fish have been shown to rapidly metabolize 99 percent of PAH compounds within 24 hours of uptake,” thus “because fish metabolize PAH compounds so efficiently, fish tissue concentrations of PAH compounds have been deemed a poor means of assessing PAH exposure.”

EPA disagrees that fish tissue concentrations are a poor means of assessing PAH exposure. In fact, direct measures of contaminant concentrations in the actual media to which receptors are directly exposed is an excellent means of assessing exposure. The LWG has repeatedly made these same claims based on selective citations of literature for several years in direct contradiction of the data the LWG itself collected and its own evaluation presented to EPA in the BHHRA. A simple literature search returned documentation that PAHs do in fact bioaccumulate in fish. For example, Rose et. al. (2012) concluded that “PAHs were found in fish of all ages therefore this result suggests that fishes are exposed to and accumulate PAHs from the early stage of their lives through different developmental stages up to maturity and that sources of

PAHs are present and available to fish in Lagos Lagoon due to regular discharges from several sources."

LWG Dispute Issue 1j:
EPA's calculation of PAH PRGs for direct contact are not explained and are not supported by the risk assessments.

EPA Position:
PRGs for direct contact exposure (including PAHs) are clearly explained in 2016 FS Appendix B, Section B3.1.1. Because PAHs were evaluated only for carcinogenic effects for RAO 1, Equations B3-2 through 7 are relevant for calculating the PRGs. As noted, exposure values are summarized in Table B3-1, and unless otherwise noted, the source for each value is provided in Tables 3-21 through 3-25 in the BHHRA. As such, identical exposure assumptions were used when calculating the PRGs. The BHHRA evaluated risk due to exposure at specific, individual areas, and as noted in Section 3.5.8.6, a factor of 25 percent was used to account for the time spent fishing in a single area within the Site, which corresponds to a "site-use factor" of 4. While the application of site-use factor may be appropriate to assess the risk within a specific area, PRGs are intended to be applied to all beach and nearshore areas of the Site. Thus, if a receptor were to only be exposed to a single area, then a site-use factor would be appropriate, but when potential exposure at more than a single area is considered likely, use of a site-use factor is no longer protective. Due to the distribution of the contamination and the multiple uses and exposure points within the Site, EPA determined that it would not be protective to use a site-use factor.

LWG Dispute Issue 1k:
There continues to be an issue with EPA's modeled dioxin/furan tissue concentrations. In the BHHRA, the site-wide risk from the total TEQ based on the 95%UCL or maximum concentration for actual tissue data was 2 x 10-4. For Alternative A, the site-wide risk from 1,2,3,4,7,8-HxCDF alone based on an average concentration is 6 x 10-4. There is no way that the risk from an individual congener can be higher than the total TEQ, and EPA's methodology therefore drastically overestimates the risk in a way that cannot be supported scientifically. The FWM is used by EPA to back-calculate concentrations of chemicals of concern (COCs) in sediment associated with acceptable, risk-based human health and ecological concentrations in fish tissue as calculated using the baseline risk assessment. This influences sediment PRGs and hence RAOs, so uncertainty originating with the FWM cascades, having compounding effects on the evaluation of remedy alternatives, and could result in additional remediation costs with no meaningful gains in risk reduction. We identify the following shortcomings with EPA's application of the FWM at the Site:

A comprehensive and detailed Conceptual Site Model (CSM) for the Site in total, and for the relationship between COC sediment and fish tissue concentrations specifically, has not been presented by EPA. This means that EPA's chief assumptions for the FWM related to steady-state conditions (in a flowing water body), the completeness of the site characterization dataset, regional contributions of COCs, and the apparent relationship between sediment and fish concentrations cannot be collectively synthesized in terms of their overall coherence and veracity.

Based on an examination of the empirical data for the Site, no statistical relationship is observed between sediment and fish tissue concentrations for DDx and PCDD/Fs at the concentrations relevant to risk decision making. This means that the FWM - which assumes such a relationship exists – is not reliable and that the conclusions reached on its basis are fundamentally flawed.

Good modeling practice was not used by EPA for the FWM, and in particular sufficient model documentation detailing the work does not exist. Adequate model documentation is one of several criteria used by EPA and other international regulators for determining the acceptability of a model for regulatory decision making (USEPA 2009, EFSA, 2014, Grimm et al., 2014).21

EPA Position:
The calculated 95 percent UCL on the mean of the 27 individual 1,2,3,4,7,8-HxCDF SWACs shown in Appendix I of the 2016 FS is 0.26 µg/kg. Using the food web model the LWG calibrated for this COC, the estimated average tissue concentration is 0.046 µg/kg, which equates to a 6 x 10^{-4} risk, as shown in Table J2.3-1a of the 2016 FS. The discrepancy noted is likely due to limitations associated with extrapolating limited dioxin/furan sediment data site-wide, particularly when combined with the limited tissue data set. Respondents' assertion that the methodology is not "supported scientifically" represents a repudiation of the analytical tools they developed, and is otherwise simply a declarative statement unsupported by fact.

LWG Dispute Issue 1l:
The Food Web Model (FWM) used to calculate sediment PRGs from tissue PRGs was calibrated using PCB data. However, the model provided unachievable results for PCBs (zero listed in EPA FS Table 2.2-5 table). Predicting sediment PRGs using this model has even greater uncertainty for other compounds (e.g. DDx). This uncertainty effects the use of the model in the near field potentially more dramatically than at a site wide basis which is particularly evident where the sediment SWAC values are uncertain by an order of magnitude. Assessing model performance along the continuum of concentrations and scales of application (site-wide or near field) to assess the goodness of fit is necessary to evaluate whether model performance is acceptable, especially in areas of uncertainty in SWAC concentration at the low concentration range driving PRG derivations.

EPA Position:
Respondent's dispute position appears to contradict their own voluminous record submitted to EPA supporting the use of a food web model for PRG development. The LWG's initial evaluation **[AR Doc # 100004067]** stated:

> The primary goal of food web modeling for the remedial investigation/feasibility study is to develop a predictive relationship between chemical concentrations in sediment, water, and tissue that can be used to derive preliminary sediment cleanup goals for chemicals that are present in fish tissue at concentrations associated with unacceptable risk.

LWG submitted a Draft Bioaccumulation Modeling Report to EPA in 2009, and again in 2015 with updated calibration for specific dioxin/furan congeners. **[AR Doc # 500012795 and 100003827]** In each submittal, the LWG stated:

> With the Round 3 sampling program, which generated substantially more tissue and water chemistry data than were previously available, there are sufficient data to use the Arnot and Gobas model for other organochlorine pesticides besides DDTs. Using data from Rounds 1-3 sampling efforts, the Arnot and Gobas model was used for all organochlorine pesticide, PCB, and polychlorinated dibenzo-p-dioxin (PCDD)/polychlorinated dibenzofuran (PCDF) COCs.

In the LWG's April 23, 2015 responses to EPA's response to comments on Section 2 of the draft FS (submitted on p. 207 of respondent's Attachment to their dispute statement), they stated:

> …the LWG agrees with the validity of the bioaccumulation model for use in calculating PRGs for the project (i.e., LWG is not challenging the accuracy of the model).

Further, the assumption of steady-state conditions is addressed in Appendix C of both the LWG 2009 and 2015 versions of the Bioaccumulation Modeling Report, which states:

> Because of a lack of adequate time-dependent data for the Portland Harbor Study Area, the model has been simplified to assume steady-state conditions for the purposes of this application.

The LWG's Draft Bioaccumulation Modeling Report ultimately concludes:

> Further, the mechanistic model can be used to estimate beyond the range of available data (e.g., to predict tissue COC concentrations lower than were found in collected fish samples). The Arnot and Gobas model explicitly accounts for the kinetics of chemical uptake and loss/dilution based on a mechanistic understanding of these processes. Because it is mechanistic, the model is appropriate for extrapolating beyond the empirically observed conditions in Portland Harbor, for example to project possible future conditions, to explore different assumptions about source terms (e.g., sediment versus lateral and upstream sources), or to calculate PRGs that fall outside the range of observed sediment concentrations. The fact that the Arnot and Gobas model is mechanistic also means that it can be calibrated to the data for a subset of chemicals and aquatic species and then "validated" with the data for other combinations of chemicals and species.
>
> The mechanistic model was applied successfully for total PCBs, select dioxin/furan congeners, and pesticides including total DDx. For all chemicals, the model met or exceeded the stated objectives outlined in this document (i.e., SPAF < 3 for smallmouth bass and < 10 for other species). The calibrated model had SPAFs < 2 for smallmouth bass for all modeled chemicals and generally < 5 for other species-chemical combinations (Section 5.4.1 and Section 6.3). Additionally, the model has been shown to perform well across a variety of chemical types (pesticides, PCBs, and dioxins), species (fish and invertebrates), KOWs, and spatial scales (Study Area-wide and smaller).
>
> In conclusion, the bioaccumulation modeling presented in this report is suitable and reliable for calculating sediment PRGs for the Lower Willamette River.

EPA notified the LWG on November 18, 2014, that the food web model supplied to EPA in 2009 was approved. **[AR Doc # 100005458]** Thus, it is not clear why respondents' now claim that the food web model is not valid for calculating PRGs, when their 2012 Draft FS (Appendix Da, Attachment 1) states:

> For the calculation of PRGs for sediment based on contaminant concentrations in tissue, the relationships between contaminant concentrations in sediment and tissue were evaluated using either the food web model (FWM) or through development of biota-sediment accumulation factors (BSAFs) or biota-sediment accumulation regressions.

Documentation of the Arnot and Gobas bioaccumulation model and its calibration, presented in Appendix B of the 2016 FS is adapted wholly from the report(s) submitted to EPA by the LWG. As noted, these submittals repeatedly assert that the food web model performs well for COCs other than PCBs (including DDx and specific dioxin/furan congeners), is suitable for calculating PRGs in sediment that are beyond the range of observed concentrations, and performs well at varying spatial scales. Absent a claim that information previously submitted to EPA in the numerous submittals referenced here were either erroneous or deliberately misleading, respondents provide no addition information that the food web model as developed by the LWG is not suitable to derive PRGs.

LWG Dispute Issue 1m:

Section 2.2.1 of the FS, under ARAR-based COCs, states "contaminants that were detected in upland media (storm water and groundwater) that may potentially migrate to the river at concentrations that would exceed the Safe Drinking Water Act MCLs and national or State of Oregon water quality criteria were also designated as ARAR-based COCs." This results in inclusion of PRGs for constituents not identified as a risk in the BHHRA. Further, it is inconsistent with EPA and DEQ rules to apply MCLs to porewater.22

EPA Position:

Regarding identification of COCs as a general matter, EPA considered comments received from the LWG and others on this issue in developing the 2016 FS and modified its approach, particularly, with identifying human health surface water COCs. After reviewing the quoted text in Section 2.2.1 and reviewing the referenced Tables, EPA understands why there is confusion about how COCs were identified. Some text in the 2016 FS in Section 2.2.1 and the referenced Tables did not get updated to account for the changes in approach used in the June 2016 FS.

All COCs for RAO 3 are risk-based. The risk is mainly due to exceedances of contaminants in fish tissue; except for chromium and MCPP where the risk was based on the drinking water pathway. The BHHRA risk for the drinking water pathway was based on exceedances of Regional Screening Levels. [See Amended Tables 2.2-2 and 2.2-3a and 3b attached to this dispute].

For RAO 3, the PRG for MCPP was based on the RSL value, which is consistent with the BHHRA. However, EPA selected the MCL for chromium as the PRG rather than the RSL for hexavalent chromium. All other PRG values are based on national or State of Oregon water quality criteria (MCLs were all greater values and were not selected). Because the food web model assumed that surface water meets water quality standards in deriving the needed reductions in sediment concentrations to achieve protective fish tissue concentrations [2016 FS Appendix B1], surface water for the contaminants in fish tissue needs to achieve water quality standards (which is the basis for the PRGs for RAO 3).

The COCs for RAO 4 are all based on the identification of COCs in groundwater plumes (see Section 1 of the 2016 FS) and are based on MCLs and EPA RSLs for tap water. EPA RSLs were only used when an MCL was not available for a specific contaminant. The quoted text from the “ARARs-based COCs” was incorrect in stating that upland storm water data that exceeded an MCL or State water quality standard was used to identify ARAR-based COCs. The text should read:

> National or State of Oregon water quality criteria, MCLs, and EPA RSLs for tap water were used to establish PRGs for RAOs 3 and 4. These values are presented in Tables 2.2-6 and 2.2-7. RSLs are only used when MCLs or other ARARs are not available for a specific contaminant.

EPA disagrees with the LWG’s long-standing position that exceedances of MCLs either in surface water or groundwater discharging to the river have no application to the Portland Harbor site. CERCLA Section 121(d) requires: (1) that any remedial action selected shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and control of further releases at a minimum which assures the protection of human health and the environment; and (2) for any hazardous substance that will remain onsite, such remedial action shall require a level or standard of control which at least attains Maximum Contaminant Level Goals established under the SDWA, and water quality criteria established under Section 304 or 303 of the CWA. 42 U.S.C. Section 9621(d)(A)). The NCP provides that “[r]emediation goals shall establish acceptable exposure levels that are protective of human health and the environment and shall be developed by considering the following: [A] [ARARs] . . . [B] . . . [MCLGs] . . . . [E] Water quality criteria established under sections 303 and 304 of the Clean Water Act . . . .” 40 CFR Section 300.430(e)(2)((i)(A), (B), and (E).

CERCLA and the NCP are clear that MCLs are to be achieved in contaminated groundwater and surface water at a site when relevant and appropriate under the circumstances of the release. MCLs are relevant and appropriate under the circumstances of the release at Portland Harbor because the designated uses of the lower Willamette River include drinking water supply. (Designated Uses for the Willamette Basin specified for the Willamette Basin at OAR 340-041-340 and 340-041-0345.) Likewise, all groundwater of the state, including the groundwater adjacent to and under the lower Willamette River, are to be protected for the beneficial use of domestic drinking water supply. (OAR 340-040-0020(3)), which is as stringent or more stringent then the “EPA Guidelines for Ground-Water Classification” (December, 1986) (See 55 FR 8732, March 9, 1990). Releases of hazardous substances have occurred to groundwater that is discharging to or under the river within the Site or has the potential to discharge to the river which exceed applicable promulgated water quality standards and relevant and appropriate Safe Drinking Water Act standards for groundwater and surface water cleanup. Therefore, it was appropriate for EPA’s 2016 FS to identify COCs and set PRGs based on MCLs for groundwater and surface water at the Portland Harbor Site. The LWG claims MCLs should not be applied to pore water. However, under the circumstances at this site, both groundwater and surface water are potential drinking water resources, and discharges of contaminants to the river represents one continuous pathway. Therefore, there is no basis to distinguish pore water from groundwater or surface water in regard to where compliance with the ARAR should be met.

LWG Dispute Issue 1n:

EPA continues to identify Regional Screening Levels (RSLs) as PRGs. For example, RAO 4 incorporates the tap water RSL for Manganese. That current manganese RSL is derived from outdated toxicity evaluation without clear adverse effects. A more recent and credible source of toxicity information (ATSDR 2012) concludes that an oral threshold value for manganese cannot be derived. Use of outdated and poorly supported toxicity criteria is inconsistent with EPA guidance.

EPA Position:

The RSL for manganese was calculated using the oral reference dose (RfD) developed by EPA's Office of Research and Development and posted in its Integrated Risk Information System (IRIS) database. Consistent with EPA guidance (EPA 2003), the toxicity values developed by the IRIS program represent Tier 1 values. This guidance states that "in general, if health assessment information is available in the Integrated Risk Information System for the contaminant under evaluation, risk assessors normally need not search further for additional sources of information." ATSDR minimal risk levels represent Tier 3 values in the recommended hierarchy. Further, respondents' assertion that the evaluation is "without clear adverse effects" mischaracterizes the information provided in both the IRIS and ATSDR assessments of oral and inhalation toxicity of manganese. While acknowledging that manganese is essential in the function of several enzymes, IRIS notes that "several disease states in humans have been associated with both deficiencies and excess intake of manganese." Epidemiological data evaluated "raises significant concerns about possible adverse neurological effects at doses not far from the range of essentially." Thus, given its role as an essential nutrient and the ubiquitous nature of manganese intake in the general population, development of the RfD focuses on what is known to be a safe oral intake of manganese for the general population, which is consistent with the definition of the RfD. Further, while respondents note that ATSDR chose not to derive an oral MRL for manganese, they fail to note that it recommend use of an "interim guidance value" of 0.16 mg/kg-day to be used for ATSDR public health assessments of oral exposure to inorganic forms of manganese. The ATSDR recommendation is essentially the same as the 0.14 mg/kg-day RfD from IRIS.

LWG Dispute Issue 1o:

EPA's FS states, "Compliance with ARARs is determined by whether an alternative will meet all of the chemical-specific, action-specific, and location-specific ARARs and/or those that are to be considered (TBC) identified in Tables 2.1-1 through 2.1-3." Table 2.1-1 identifies EPA Regional Screening Levels for groundwater as TBC values. "TBCs are not ARARs … but may be considered and used as appropriate, where necessary to ensure protectiveness."

EPA Position:

The FS statement and the CERCLA Compliance with other Laws Manual are not inconsistent. A more complete quote from the CERCLA Compliance with Other Laws Manual indicates that chemical-specific TBCs can be surrogates for ARARs when needed to ensure protectiveness:

> TBCs are not ARARs, but chemical-specific TBC values such as health advisories and reference doses will be used in the absence of ARARs or where ARARs are not sufficiently protective to develop cleanup goals (see discussion of risk assessment in Section 1.2.3.1 below). In addition, other TBC materials such as guidance or policy documents developed to implement regulations may be considered and used as appropriate, where necessary to ensure protectiveness.

It is not inconsistent with the NCP to evaluate whether remedial alternatives will achieve chemical-specific, numeric TBCs identified in the 2016 FS as PRGs. "Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs." [40 CFR 300.430(e)(9)(iii)(A)]. Nonetheless, only PRGs based on ARARs were the basis for EPA's determination in the 2016 FS that Alternatives B and D would not meet the second threshold criteria. The ARARs analysis of the alternatives was based on the mass balance analysis contained in Appendix K to the 2016 FS. The Appendix K analysis only looked at COCs that were in sediment and their effect on surface water using a mass balance approach. All of the PRGs for RAO 3 analyzed in Appendix K are based on national recommended ambient water quality criteria developed under the CWA or Oregon's water quality standards, no TBCs. MCPP (which is the only PRG for RAO 3 based on the RSL TBC) was not evaluated in Appendix K because there are no sediment exceedances. Therefore, the determination that Alternative B and D would not meet all ARARs did not use TBCs.

LWG Dispute Issue 1p:

EPA establishes a PRG for total chromium; however, only hexavalent chromium was identified in the human health risk assessment as potentially posing unacceptable risk.

EPA Position:

Hexavalent chromium was identified as posing unacceptable risk via use of surface water as a drinking water source for both the RME and CTE evaluations. The risk assessment used the EPA RSL of 0.035 µg/L. Consistent with the NCP [40 CFR 300.430(e)(2)(i)(B) and (C)], the PRG for a drinking water source was set at the MCL, which is for chromium. The MCL for chromium is 100 µg/L. As stated in the 2016 FS, RSLs were only used where MCLs were not available. The risk management decision in the 2016 FS was that use of the MCL was sufficient to protect for risks from hexavalent chromium. It is noted that if a risk-based PRG for hexavalent chromium were derived it would be four orders of magnitude lower than the MCL.

LWG Dispute Issue 1q:

The RI and BLRAs do not provide information or a foundation for establishing cleanup goals or remedial actions for source control. The LWG has previously commented that EPA should not establish PRGs or RAOs for source control media that were not assessed in the BLRAs or RI.

The June 2016 FS uses a new rationale for including riverbanks in the FS. "Since river bank contaminations (sic) are directly linked to the sediment bed and receptors through proximity and source and migration pathways, the known areas of contamination are included here and elsewhere in the FS. Including these areas supports the evaluation of and selection of alternatives in case it is determined that river bank contamination is best suited for remediation *in conjunction with in-river activities." This new rationale does not address the LWG's prior stated concerns.*

The FS references an attached riverbank database, but the database was not included. Consequently, the Disputing Respondents continue to have no way to verify any of EPA's FS decisions regarding remediation of the river banks. Regardless, prior LWG issues with EPA's source control approach remain. These issues include that PRGs should not be established based on exposure pathways being evaluated in upland source control evaluations under DEQ oversight, and that none of these upland media were evaluated in the BLRAs or Remedial Investigation (RI). EPA's use of sediment PRGs for riverbanks, even on areas rarely inundated and without considering attenuation, is technically inappropriate. Delineations of groundwater plumes and riverbanks, and a zero post-construction restoration time frame are arbitrary. There is a total lack of data and analysis as to what risk considerations are driving the specific remedial actions delineated (and therefore how this will be refined in the design phase when further data/analysis is available) and what specific remedial actions will be implemented in which areas driven by those risks. This arbitrary delineation is then carried forward into the evaluation of alternatives and given weight for assessing the relative effectiveness of alternatives. Further, the last-minute incorporation of riverbanks in the FS, when they have not been fully delineated, is counter to EPA policy and guidance.

In February 2001, a Memorandum of Understanding related to the Site was executed among EPA, Oregon DEQ and several state, federal and Tribal natural resource trustees. That MOU provided that EPA would be the lead agency for investigating and cleaning up contamination in the river sediment and DEQ, using state cleanup authority, was designated as the lead agency for identifying and controlling upland sources adjacent to or near the river. Pursuant to that MOU, the Portland Harbor Joint Source Control Strategy was finalized by EPA and DEQ in December 2005. Since that time, many owners and operators of facilities along the river, including several of the Disputing Respondents, have been actively involved with DEQ, planning and implementing source control measures. In the FS, EPA has ignored many of those fully or partially completed actions and identified groundwater and riverbank concerns that in some instances simply don't exist anymore, and in others are sites where property owners have agreed upon remedies to be implemented under DEQ oversight at or before the time of the in-water remedy. There is no reason for EPA to now both ignore and undermine those efforts by inserting RAO 9 into the FS, ignoring completely the DEQ Upland Source Control Update Summary Report most recently updated by DEQ in March 2016.

Several site-specific examples of errors arising from EPA's determination to select remedies for riverbanks without any foundation in the RI or risk assessments are set forth in the Appendix, attached and incorporated herein. To take a representative example, the FS does not account for upland work already performed by NW Natural at the Gasco facility pursuant to its DEQ Voluntary Agreement and in close coordination with EPA, the result of which leads to EPA to include presumptive excavation with presumptive cover material along the entire Gasco Sediments Site riverbank in all alternatives. This presumptive riverbank remedy is not supported by technical rationale, prevents meaningful comparison of the performance of technologies and limits the evaluation of multiple technologies that may perform equally effectively, is inconsistent with the range of technology assignments evaluated along different portions of the Gasco Sediments Site riverbank in the May 2012 Gasco Engineering Evaluation/Cost Analysis, and *does not account for known impacts that will occur to existing upland structures and potential future upland source control structures. Similarly, The FS ignores that Gunderson has implemented permanent riverbank source control measures at some riverbank areas that are identified by EPA as needing remediation under the oversight of the Oregon DEQ and in accordance with the requirements set out in the DEQ-EPA Portland Harbor Joint Source Control Strategy. Gunderson has also completed interim source control measures under DEQ oversight at the remainder of the riverbank areas that are identified by EPA in the FS and agreed that additional permanent measures will be implemented concurrent with the adjacent in water remedy. And the FS ignores the riverbank remedial action implemented by Evraz at its Rivergate property, a remedial action based on a source control decision made by the Oregon Department of Environmental Quality and concurred with by EPA.*

EPA Position:

The LWG did not provide any legal or technical basis for its position that EPA should not address river banks as part of the in-river response action. The LWG argues the river banks are a different media that was not evaluated in the risk assessments, thus, EPA cannot or should not address them. Although soils may be a different "media" from sediment as a general matter, the LWG's argument ignores the site-specific facts at this Site. The baseline risk assessments determined there was unacceptable risk to human health and the environment from multiple contaminants found in surface water, sediment, groundwater and tissue. Many of those same contaminants, plus other contaminants that have been found to exceed ARARs in groundwater, are detected the river bank soils (both surface and subsurface) exceeding the PRGs for sediment, groundwater and/or surface water. The data gathered by ODEQ on the river banks is in the administrative record (See Appendix A to the 2016 FS). Maps 3.4-14a-h in the 2016 FS illustrates that the contamination in the river banks is immediately adjacent to and at most locations likely a mere extension of the contamination in the river. Currently the contamination in the river banks is uncontrolled and either is migrating or has the potential to migrate to the river. There are tidal fluctuations twice daily, submerging portions of the river bank throughout the day potentially exposing aquatic receptors to the river bank contamination. Furthermore, the river water levels rise and fall seasonally, thus, again submerging different portions of the river bank throughout the year. Other forces, sheet flow, gravity, or upland land uses, can lead to river bank soils eroding into the river. CERCLA and the NCP provide EPA with broad authority to take response action on releases or threatened releases of hazardous substances to the environment. The river banks as well as all upland sources are within the boundaries of the Portland Harbor Superfund Site. There is sufficient information and foundation in the 2016 FS and administrative record to support EPA taking action on river banks as part of the in-river portion of the site.

The 2001 MOU between EPA, ODEQ, Tribes and Federal and State Trustee agencies established the framework for roles and responsibilities for addressing the Portland Harbor Superfund Site. **[AR Doc # 1128679]** The MOU is an administrative tool and framework for coordination between all of the government agencies involve with the site. Section IV. A.1. of the MOU provides that DEQ is designated Lead Agency for the upland portion of the Site. EPA will be the Support Agency. The MOU further provided that "DEQ may elect for any reason to ask EPA to assume the Lead Agency role for any discrete facility(s) or portion(s) of the upland portion of the Site at any time." Furthermore, Section VII.D. states that: "The Parties recognize that each Party reserves all rights, powers, and remedies now or hereafter existing in law or in equity, by statute, treaty, or otherwise. Nothing in this Agreement is or shall be construed to be a waiver of the sovereignty of a signatory Party. This Agreement is intended solely for the purposes of facilitating inter-governmental cooperation between the Parties, and creates no rights in third parties or the right to judicial review." EPA retains all of its authorities to address any portion of the Portland Harbor site.

The inclusion of river banks was not last minute. In fact, DEQ requested we address some river banks as far back as 2012. **[AR Doc # 100013966 and 100013967]** Riverbanks were included in the 2015 version of the FS that the LWG was provided to comment on. The LWG was provided drafts of EPA's Section 1 of the FS, which identified river banks in early 2014. EPA identified contaminated river banks adjacent to in-river SMAs in coordination with ODEQ, who is the support agency for this Site and oversaw the collection of the river bank data. EPA sought ODEQ's input on the information presented in Section 1 of the 2016 FS. **[AR Doc # 100009725, 100009726, 100005299, 100005300, 100005518, 100005534 and 100005537]**

Furthermore, the SMAs are based on RALs, not PRGs, and were extended from in-river sediment to those river banks that were identified as contaminated since it is likely that those river banks are sources of the sediment contamination and are equally, and likely more, contaminated than the in-river sediment. The LWG provides no evidence contamination in river banks would significantly attenuate prior to exposure to in-river receptors or migration to the completely submerged portion of the river. To the contrary, known facts are that the contaminants being evaluated do not readily degrade and there is no deposition occurring on riverbanks or most SMAs adjacent to the riverbanks. Further, if there are concentrations in the river banks that exceed sediment PRGs, then they have the potential to erode and recontaminate the sediment. The delineation of groundwater, river banks, and sediment are all based on limited data and EPA agrees that refinement of these areas will need to be conducted in remedial design.

Source control actions are interim actions conducted under DEQ authority are not final CERCLA actions. EPA will evaluate the effectiveness of any source control actions conducted under DEQ authority with final remedy objectives and making the determination as to whether further action is warranted if significant risk of recontamination is found. Where early source control actions meet the requirements of the ROD, then EPA will not require further action to be taken in those areas. EPA cannot make such a determination in the FS, as it predates the ROD, but EPA did assume that all sources, other than river banks and groundwater plumes extending beyond an upland control measure, are controlled in the 2016 FS for purposes of determining what amount of sediment cleanup would be required to be protective of human health and the environment. Therefore, contaminated riverbanks that could recontaminate the in-river cleanup and upland groundwater plumes that are beyond the upland control point need to be addressed by the in-river remedy.

<u>LWG Dispute Issue 1r:</u>

The Feasibility Study is the appropriate point for EPA to bring in risk management principles. EPA's sediment guidance directs that cleanup objectives "should reflect objectives that are achievable from the site cleanup." The FS should therefore focus on those chemicals and cleanup levels that are technically practicable to be reached through a sediment remedy based on site-specific considerations.

Equilibrium. A sediment remedy must include evaluating what is deposited within the Study Area, both physically and chemically (i.e., potential future bedded sediment equilibrium). EPA has not conducted such an evaluation. The assumption that background sediment concentrations are the same as equilibrium is invalid. The cleanup goal for PCBs of 9 parts per billion (ppb) based on EPA's calculation of background concentrations is not achievable or sustainable by existing technology nor by nature itself. Experience gained at other sediment remediation projects conducted nationally and in Region 10 strongly argue that background should not be used to establish cleanup goals when likely ongoing contaminant inputs from upland sources within the Site and upriver of the Site exceed EPA's calculation of background. The LWG provided EPA an evaluation of equilibrium concentrations for the Site. Equilibrium is the only reliable indicator of future concentrations that can be achieved.

Perhaps the most important certainty at the Site is that the Lower Willamette River flows from south to north. As part of the flow, the river carries sediments which are deposited within the Site. Equilibrium is controlled in large part by concentrations of contaminants in the incoming sediments from upstream. This creates a bounding condition such that no amount of active remediation within the Site can achieve or sustain concentrations lower than that of the equilibrium level. Based on relevant empirical data collected by the LWG, no sediment remedy is likely to achieve PCBs lower than 20 ppb in the foreseeable future.

Realistic Exposures. As described in the Sediment Guidance: "A risk management process should be used to select a remedy designed to reduce the key human and ecological risks effectively." One of the fundamental flaws in the FS is the absence of any explicit, documented risk management. The term "risk management" is never used in the June 2016 FS or the Proposed Plan. Risk management in the Superfund program requires the consideration of the advantages and disadvantage of cleanup alternatives and balancing of trade-offs. This analysis includes an evaluation of the uncertainties at the Site, including uncertainties in the reliability of the exposure data used to identify the risks. One of the key factors in decision-making is: "[t]he likelihood of the exposure actually occurring should be considered when deciding the appropriate level of remediation, to the degree that this likelihood can be determined." At Portland Harbor, the risk assessments, particularly for human health, are built on a cascade of unrealistic and improbably conservative assumptions regarding exposure and durations. Unacceptable risks to various consumers of fish are based on questionable assumptions of how many resident fish people eat, from which areas of the river, how the fish are cooked, and for how many years any one person eats them. The assumptions are not placed in an overall estimate that is conservative but within a realistic range of exposure, as required by the NCP. EPA's description of this risk – people should eat no more than 6 fish meals every 10 years – is not well explained in terms of the exposure assumptions supporting the risk and those locations within the Site that actually pose an unacceptable risk for consumption of resident fish. Further, the assumptions are not comparable to assumptions used at other large sediment sites.

And, most important, EPA's June 2016 FS fails to document how the risk assumptions have been considered when evaluating alternatives. Nowhere in EPA's FS are the exposure assumptions with respect to risks from fish consumption expressly stated. Rather, the FS simply describes astronomical risks at the Site and the extraordinary measures needed to address such largely illusory risks. The absence of such information in EPA's FS demonstrates that an important *element of risk management -- the reliability of the exposure assumptions -- has not been sufficiently considered.*

Finally, the FS does not identify which areas of the Site currently pose the highest risk and should be prioritized for remediation. At a 10-mile Site that, according to EPA's FS, encompasses nearly 300 acres requiring active remediation and likely close to 20 years to perform, it would seem necessary and prudent to establish a basis for prioritizing and sequencing the cleanup of the higher risk areas. EPA's failure to do so shows that it is not effectively managing the actual risk.

EPA Position:

EPA guidance does not require an evaluation of equilibrium; however, EPA did evaluate equilibrium at post construction. EPA endorses the concept of equilibrium, however, the necessary information (sediment trend data) is not available to conduct an equilibrium evaluation in the long-term. EPA has developed background concentrations consistent with EPA policy and guidance. EPA has further looked at the sediment traps deployed in the upriver reach, which corroborate the values developed from the upriver sediment. The scatter plots of PCBs from the RI Report (Figure 5.2-1) shows that there are concentrations within the site that are already at or approaching the calculated background concentration of 9 µg/kg. EPA has been coordinating with DEQ on source control actions in the downtown reach and upland areas of the Site to ensure that sources will be sufficiently controlled that they will not recontaminate the Site. Therefore, there is no information available that indicates that background concentrations would not be achievable. Further, the lower Willamette River does not flow with certainty from south to north. There are several instances where the river flow reverses, which is an important aspect of the CSM and has been acknowledged by the Respondents (see LWG draft RI 2011, **AR Doc # 100006009**). The equilibrium evaluation conducted by LWG included sources that are being controlled under DEQ authority; thus, EPA deems that evaluation not relevant to current Site conditions.

Appropriate risk management was applied in the 2016 FS. The fact that there is no overt "risk management" section in the 2016 FS, or that EPA arrived at different conclusions than did the LWG in their 2012 draft FS, Appendix E (which was rejected by EPA), does not mean that such information was not considered in the development of the remedial alternatives in the 2016 FS, not the least of which was to assign MNR to the vast majority of the site in areas where contaminant concentrations – and thus the relative risk – are lower than within the SMAs.

EPA is well aware of the LWG's objections to the risk assessment, including assumptions regarding fish consumption, on which they previously invoked the formal dispute process under the AOC. Respondents are referred to the final dispute decision for resolution regarding these issues. **[AR Doc # 715198 and 715199]** We do note the contradiction here with other sections of the LWG's FS dispute that argue that analyses presented in the 2016 FS need to be consistent with the approved risk assessments. But here respondents request that the approved risk assessments be discarded or simply ignored in the name of "risk management," Respondents' did in their draft 2012 FS, leading to their conclusion that "there is sufficient scientifically valid evidence that baseline conditions might already meet the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) threshold criterion for overall protection of human health and the environment." And while the purpose of the FS is not to once again recreate the risk assessments, exposure assumptions for all pathways are provided in Table B3-1 of the 2016 FS, areas of the Site that pose unacceptable risk (defined as sediment concentrations exceeding risk-based PRGs) are presented in Figure 2.2-2 of the 2016 FS. Finally, Section 3.4.1 of the 2016 FS defines SMAs as "areas with the most widespread contaminants that pose the highest risks," which are targeted for remediation through constructed remedial technologies.

LWG Dispute Issue 1s:

EPA does not explain its conclusion that Alternative B alone fails to comply with ARARs. Although EPA's August 2015 FS found that all alternatives met ARARs, this FS concludes that Alternative B would not meet certain water quality criteria. It is unclear how EPA reaches this conclusion only as to Alternative B, since EPA states elsewhere that it lacks information to evaluate the effectiveness of meeting these criteria for any of the alternatives under consideration.

Information in the RI demonstrates that surface water quality criteria for some COCs (e.g., PCBs and D/F) will never be met by any sediment cleanup at the Site because of upstream concentrations. EPA notes on page ES-17 of the FS, "It is expected that MNR in conjunction with ICs and source control, including control of upriver sources, is necessary to achieve surface water RAOs."

Similarly, MCLs are likely not achievable throughout the spatial extent of some groundwater plumes along the shoreline or out under the river, and achievement of such criteria are not necessary to design and implement groundwater and sediment remedies that are protective of all reasonable and likely future uses of groundwater. EPA should either determine that MCLs are not applicable, relevant or appropriate because MCLs do not apply to the groundwater in this context, or it should waive these water quality criteria ARARs now. MCLs are not applicable, relevant or appropriately applied to groundwater here because the Oregon statute designates the Lower Willamette River as a potential public and private water supply only following adequate pretreatment and because the federal Safe Drinking Water Act under which MCLs are developed designates that drinking water is appropriately sampled at the point of distribution.

EPA Position:

The 2016 FS Section 4.2.2.2, pp 4-20 to 4-21 states:

> Exceedances of water quality criteria for protection of human health from contaminated sediment within the Site would continue for PCBs, cPAHs, and 2,3,7,8-TCDD eq at the completion of construction. There is insufficient surface water data to evaluate the effectiveness of this alternative in meeting the aquatic life water quality criteria for BEHP, PAHs and TBT. All other chemical specific ARARs are achieved with this alternative. Ethylbenzene from contaminated groundwater is expected to be addressed to achieve RAO 8 through implementation of source control measures. However, Alternative B only addresses 16 percent of the sediments impacted by groundwater. Alternative B, in conjunction with adequate upland and upriver source control measures, would not achieve numeric human health and aquatic life water quality criteria and drinking water MCLGs and MCLs. Long-term monitoring and maintenance of engineering controls, pore water, and surface water assist in evaluating the ability of this alternative to achieve chemical specific ARARs.

In conducting the analysis of achieving water quality ARARs from sediment remedial actions in the Site, EPA separated the upriver and downtown contributions of contaminants from the Site contribution of contaminants (see Appendix K and Figures 4.2-8a and f for PCB and dioxin/furan evaluation, respectively). EPA states in all alternatives (including Alternative B) that it lacks the information to conduct an analysis on smaller spatial scales and for RAO 7 PRGs. However, an analysis was conducted for RAO 3 PRGs on a site-wide scale. EPA's analysis shows that Alternative B does not sufficiently reduce the load of contamination from sediment to surface water such that water quality ARARs could be achieved.

See EPA position on LWG dispute issue 1g regarding background for surface water.

Please see EPA position on LWG dispute issue 1g for the legal bases and site-specific reasons why MCLs are relevant and appropriate to releases at this Site. There has been no information or analysis provided to the EPA to date that supports a waiver of MCLs at this site. It is EPA's expectation that DEQ's upland source control actions will adequately address groundwater contamination (the plumes). EPA's RAOs are focused on containing and reducing migration of COCs from groundwater to surface water and biologically active areas of sediment. Should groundwater not be addressed adequately under DEQ's actions, EPA may, at a future time, determine if action is warranted under CERCLA to further address groundwater contamination. [Section 2.2 of the 2016 FS] Likewise, if during remedy implementation it is discovered and demonstrated that achieving MCLs is not technical practicable a waiver of that ARAR may be found necessary. [Section 2.1.2 of the 2016 FS]

LWG Dispute Issue 2
EPA's June 2016 FS continues to lack complete and transparent evaluation of the long and short-term effectiveness and cost of its alternatives, as well as of the degree to which those alternatives reduce the toxicity, mobility or volume of hazardous substances through treatment, including treatment of PTW.

LWG Dispute Issue 2a:
EPA's inadequate conceptual site model does not provide a foundation for a thoughtful comparative evaluation of alternatives. The June 2016 FS does not sufficiently describe the relevant Site features, baseline risks, role of sources, fate and transport, and site uses and other important factors necessary to understand the potential cost effectiveness of various remedial technologies or EPA alternatives. Information on contaminant fate and extent is completely missing from the CSM discussion. In fact, the site has been characterized by EPA based on aggregated sediment data without regard to time dependent changes that reflect the kinetics of rate and extent operating in this system. It is not possible to accomplish a valid alternatives evaluation without an adequate operationalized theory and model of the site. The LWG previously commented that EPA's August 2015 draft FS needed a more balanced presentation of all sources in Section 1 (groundwater, riverbank, and stormwater). Again, this FS neglects to include a discussion of stormwater sources to the Site.

In the June 2016 FS, EPA added sites and edited the discussion of riverbanks and groundwater in Section 1. Based upon our preliminary review, the identification and presentation of these sites contains multiple errors set forth in the attached Appendix. For example, PCBs are listed as *a riverbank contaminant at Arkema, but have only been detected in a small number of samples below the applicable screening levels (with one exception for a conservative bioaccumulative SLV). Further, the June 2016 FS neglects to include a discussion of upland source controls that have been implemented and the performance of those source controls in the remedial evaluations, such as the riverbank remedial action that has been completed at the Evraz Rivergate site under DEQ oversight and with EPA concurrence. The Time Oil groundwater plume identified in section 1.2.3.4 is fully controlled and meets JSCS values for all constituents other than potentially arsenic, which does not appear to be associated with site-related groundwater contamination.*

EPA Position:
The conceptual site model is presented in the RI Report. The 2016 FS provides the relevant information required per EPA guidance [*Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (1988), *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (2005)]. The Respondents do not provide enough specificity as to the information absent regarding relevant Site features, baseline risks, fate and transport, and other Site uses. EPA describes contaminated media and the extent of contamination, but does not describe sources or source control in the 2016 FS Report. EPA provided a link to the DEQ source control report, which discusses in great detail the current status of source control and since that is not part of the action being taken, that level of detail did not need to be discussed in the 2016 FS. EPA's assumption in the 2016 FS was that all sources would be controlled. EPA used the information available to describe the fate and extent of the contamination in the Site.

EPA's *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (2005) recommends that modeling be conducted at large complex sediment sites, but does not require the use of a specific model. Further, the guidance states:

> These modeling efforts typically require large quantities of site-specific data. Where numerical models are used, verification, calibration, and validation typically should be performed to yield a scientifically defensible modeling study.

and

> …it is important that both calibration and validation be conducted at the space and time scales associated with the questions the model must answer.

The LWG in their 2012 draft FS states:

> Appendix Ha (pp 26-27): "Because somewhat limited data were collected at the beginning of the model simulation period, and because the sediment data from that time did not fully characterize sediment levels uniformly throughout the site, the entire FS sediment dataset, which includes sediment data collected between 1997 and 2010 has been deemed representative of current conditions in the site."
>
> Appendix Ha (p 46) that is say that "assessment of temporal changes in these data is difficult because this was not and objective of the historical sediment sampling programs

> … and as such, sediment data were generally examined qualitatively during model calibration."

Thus, Respondents themselves have acknowledged that the data necessary to develop a predictive model does not exists and that any model developed would have great uncertainty in predicting the outcomes of any alternative developed for the Site.

As stated above in EPA's response to LWG's issue 1q, early source control actions conducted under DEQ authority are not final CERCLA actions. The MOU puts DEQ in the lead and EPA has not approved the interim measures taken to date. Before beginning construction of the remedy, EPA will evaluate the effectiveness of source control actions conducted under DEQ authority with final cleanup objections to assess the likelihood of recontamination before taking in-river action. With respect to riverbanks identified in the ROD that are to be addressed, EPA anticipates that during remedial design that any early source control measures that have been taken will be evaluated to determine if further action under the ROD is warranted.

LWG Dispute Issue 2b:

EPA's alternatives evaluation is incomplete and almost entirely qualitative. EPA's June 2016 FS does not provide quantitative long-term effectiveness estimates, provides only very limited quantitative short-term effectiveness estimates, and attempts no cost-effectiveness evaluation.

EPA Position:

As discussed in the 2016 FS Section 4.1.5, long-term effectiveness and permanence refers to the expected residual risk and the ability of an alternative to maintain reliable protection of human health and the environment over time, once PRGs are achieved. Quantitative residual risk estimates are developed in the 2016 FS Appendix J Section J1 and presented in Table J1-1.

The evaluation of alternatives includes both quantitative and qualitative analysis of long-term and short-term effectiveness. The 2016 FS has provided quantitative estimates of residual risk for long-term effectiveness. The 2016 FS provides a quantitative evaluation of the remaining risks post-construction and qualitatively evaluates the time to achieve cleanup goals. The LWG provided no regulatory or guidance references that require a rigorous quantified analysis as they suggest EPA's FS should have done. EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (1988) states that the following factors are to be evaluated for short-term effectiveness:

Table 6-3. Short-Term Effectiveness

Analysis Factor	Basis for Evaluation During Detailed Analysis
Protection of community during remedial actions	! What are the risks to the community during remedial actions that must be addressed? ! How will the risks to the community be addressed and mitigated? ! What risks remain to the community that cannot be readily controlled?
Protection of workers during remedial actions	! What are the risks to the workers that must be addressed? ! What risks remain to the workers that cannot be readily controlled? ! How will the risks to the workers be addressed and mitigated?
Environmental impacts	! What environmental impacts are expected with the construction and implementation of the alternative? ! What are the available mitigation measures to be used and what is their reliability to minimize potential impacts? ! What are the impacts that cannot be avoided should the alternative be implemented?
Time until remedial response objectives are achieved	! How long until protection against the threats being addressed by the specific action is achieved? ! How long until any remaining site threats will be addressed? ! How long until remedial response objectives are achieved?

The guidance does not require the analysis be quantified. The quantitative and qualitative evaluations conducted in the 2016 FS are sufficient for an FS-level analysis.

A cost-effectiveness evaluation is not a requirement for a FS per the NCP and is not suggested in the RI/FS guidance. What is required and what was done is an individual and comparative analysis of the individual balancing criteria (long-term effectiveness and permanence, short-term effectiveness, and cost (in addition to reduction of T/M/V through treatment) that are ultimately used to make a cost-effectiveness determination. The cost-effectiveness determination is made as part of remedy identification and selection through the preferred remedy in the Proposed Plan and then the final remedy documented in the ROD (this is discussed in EPA's *The Role of Cost in the Superfund Remedy Selection process*, EPA 540/F-96/018, Sept 1996). Thus, EPA was not remiss in not including a cost effectiveness evaluation in the 2016 FS.

EPA fails to explain its technical analyses, many of which appear to contain significant errors. Many of the new analyses EPA added to this FS appear to be technically incorrect and based on broad generalities, such as the surface water analysis approach included in Appendix K. This analysis appears to assume that surface water column concentrations will decrease by the same percentage as surface sediment SWACs, which ignores other inputs that will not change when sediments are remediated such as stormwater, groundwater, and upstream inputs.

EPA Position:

The surface water analysis approach included in Appendix K of the 2016 FS only evaluated contaminants in sediment that exceed ARARs in the water column. The analysis assumes that the surface water in the Site will decrease by the same percentage as the sediment SWACs. This analysis was only conducted on a Site-wide scale since there was insufficient data to conduct an analysis on a smaller scale. In order to account for the relationship between Site sediment and surface water concentrations, EPA subtracted out the contribution from upriver and downtown sources in the water column in conducting this analysis; thus, did not ignore other inputs to the Site. Since EPA further assumed in the 2016 FS that all upland sources to the river would be controlled, the only remaining input to the surface water is contaminated sediment. EPA disagrees that stormwater, groundwater and upstream inputs will not change since DEQ has been working with entities to control upland and upriver sources to the Site throughout the RI/FS process and will continue these efforts post-ROD.

Abbreviated short-term effectiveness evaluation. The June 2016 FS continues to inadequately address short-term effectiveness, particularly for an FS with alternatives that may require decades to complete. The FS makes no attempt to quantify impacts to the community, construction workers, and the environment except based on construction duration.

EPA Position:
See EPA Position to UPRR's dispute issue 5.

EPA's June 2016 FS does contain a limited evaluation of dredge release impacts. As the LWG has previously commented, guidance strongly recommends a comprehensive and quantitative evaluation of dredge release impacts. The June 2016 FS has a somewhat enhanced discussion of dredge residuals and releases, but no new quantitative evaluations were added. The June 2016 FS does not present a comprehensive and quantitative evaluation of dredging releases, the impacts on short-term effectiveness during dredging, and the associated increases in both human health and ecological risks. EPA continues to cite the findings of one project (Hudson River Phase 2) as the basis for its assumption that contaminant releases during dredging in Portland Harbor will be only 1% of the total contaminant mass dredged (as compared to the 3% recommended by the LWG). EPA further uses this one project to support the concept that most of the releases greater than 1% can be eliminated by quickly covering dredge residuals, which is not fully supported. EPA implies elsewhere that residual covers should be applied on a daily basis, a requirement without precedent for a project of this scale. However, the impacts of such an approach on costs and duration of the alternatives are not quantified or further evaluated.

> *Issue 9. Dredge Releases Only Qualitatively Evaluated – EPA discusses dredge release issues in several paragraphs in Section 3 and evaluates them qualitatively in the Section 4, but neither Sections 3 nor 4 contain any quantitative assessment of potential dredge releases associated with the alternatives. Dredging releases are a well-recognized issue related to the short-term effectiveness of sediment removal that increases both human health and ecological risks. It is one of the main contributors to construction phase environmental impacts, particularly for alternatives that involve substantial dredging, such as those proposed by EPA. Per guidance (EPA 2005a), a comprehensive and quantitative evaluation of those impacts is required:*
>
> > *• "Generally, the project manager should assess all causes of resuspension and realistically predict likely contaminant releases during a dredging operation."*
> > *• "To the extent possible, the project manager should estimate total dredging losses on a site-specific basis and consider them in the comparison of alternatives during the feasibility study."*
> > *• "Dredging residuals have been underestimated at some sites, even when obvious complicating factors are not present."*
> > *• "Project managers should be aware that most engineering measures implemented to reduce resuspension also reduce dredging efficiency. Estimates of production rates, cost, and project time frame should take these measures into account."*

• *"The strategy for the project manager should be to minimize the resuspension levels generated by any specific dredge type, while also ensuring that the project can be implemented in a reasonable time frame."*

The LWG disagrees with several aspects of EPA's limited analysis of dredge releases.

a. EPA uses limited qualitative evaluations of the range of release rates that can be expected for typical environmental dredging projects and the role of postresidual covers in reducing release rates. In a memorandum provided in 2013 (which are not cited in the revised FS) EPA relies on two recent projects (Lower Duwamish Boeing Plant 2 Early Action Area dredging and the Hudson River Phase 2 dredging) to support the contention that 1 percent overall releases are likely across Portland Harbor. The 1 percent release rate for the Boeing project is not supportable from the actual project data. EPA ignores the six case studies presented in Table 6.2-12 of the 2012 draft FS constructed from 2004 to 2009, all of which are based on detailed site specific data collection as summarized in the table. Thus, EPA is establishing a 1-percent release rate based on one project (Hudson River Phase 2) that appears to be one of the lowest release rates documented to date. Further, EPA is applying this optimistic release rate from a site that is entirely different both chemically and physically from the Portland Harbor Site, which includes 10 river miles of highly varying physical and chemical conditions. The 2012 draft FS provides summaries of six case studies from within the last 10 years with observed average total release rates in the 3% range, and the LWG still believes this is a more realistic assumption for the revised FS. More details supporting the LWG's disagreements on this subject can be provided.

b. EPA describes on page 3-19 relatively detailed requirements for determining dredge completion and post-dredge sampling of the residuals, which in this particular case appears far too detailed for an FS-level discussion and does not appear to help determine the characteristics of the alternatives presented in Section 3. As described under Comment 1, EPA should leave such specific determinations to a performance-based ROD approach supported by a sitespecific engineering assessment in RD.

<u>EPA Position:</u>

EPA's *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (2005), Section 6.5.5 "Predicting and Minimizing Sediment Resuspension and Contaminant Release and Transport During Dredging" states:

> Some contaminant release and transport during dredging is inevitable and should be factored into the alternatives evaluation and planned for in the remedy design. Releases can be minimized by choice of dredging equipment, dredging less area, and/or using certain operational procedures (e.g., slowing the dredge clamshell descent just before impact with the sediment bed).

The 2016 FS explicitly states that some contaminant release is inevitable in the alternative assembly and evaluation (see Sections 3.4.8.5, 3.4.8.6, 3.4.8.10). The discussion focuses on technological and operational procedures for lessening release and resuspension.

EPA's *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (2005), Section 6.5.5 "Predicting and Minimizing Sediment Resuspension and Contaminant Release and Transport During Dredging" further states:

> To compare various remedies for a site, to the extent possible, the project manager should attempt to estimate the downstream mass transport and the degree of increase (if any) in downstream surface water and surface sediment contaminant concentrations. However, at present, no fully verified empirical or predictive tools are available to quantify the predicted releases accurately.

The 2016 FS release estimate emphasizes results from Phase 2 of the Hudson River dredging because it was a recent (2011-2015), large, multi-year dredge project, with site and operational characteristics similar to the dredging proposed in the feasibility study (contaminated sediment removal in a large, riverine environment with multiple mechanical dredges using barge transport). Hudson River Phase 2 dredging operations incorporated lessons learned from Phase 1 dredging and based recommendations from the Hudson River Peer Review Panel. Thus, the project represents state-of-the-art approaches for managing dredge releases while maintaining (or increasing) productivity. The Peer Review Report states, "The repeated dredge passes and prolonged exposure of sediments in the certification units (CU) resulted in increased PCB resuspension and release." To minimize resuspension and release, the Panel recommended to improve depth of contamination estimating procedures and to:

> "Establish BMPs to limit sediment resuspension and release.
>
> Perform confirmation sampling in each 1-acre sub-CU as soon as possible after attainment of the DoC Elevation in 95 percent or more of the area is confirmed by EPA.
>
> Place a 3-6 inch sand cover over sub-CU as soon as possible after confirmation samples are collected (before PCB analytical results are obtained).
>
> Use PCB analytical results of composited surface samples to determine whether an area will be backfilled or capped and install final layers accordingly."

Per these recommendations, the 2016 FS also emphasizes BMPs to limit sediment resuspension and release and placement of residual sand cover to lessen releases.

Further, on September 10, 2013, EPA provided the LWG with a memo from USACE regarding dredge residuals. **[AR Doc ID # 500001131 and 500001132]** EPA used this analysis and the recommendations from USACE in developing the 2016 FS.

There is nothing in the 2016 FS on page 3-19 that discusses dredge residuals; thus, EPA is unclear as to the disputed issue raised by Respondents. EPA believes that the analysis conducted in the 2016 is appropriate level of analysis necessary for this Site. EPA does not have a "performance-based ROD approach" as purported by Respondents (See EPA's *A Guide To Preparing Superfund Proposed Plans, Records Of Decision, And Other Remedy Selection Decision Documents* (OSWER 9200.1-23P).

EPA assumes that construction and use of sheet pile barrier walls as dredge water quality control measures based on the presence of NAPL in water depths less than 50 feet (see Appendix O) will support the short term effectiveness of all alternatives. The FS still fails to incorporate *the time to install sheet pile walls in each alternative's duration or lower production dredging within the confined space and does not evaluate the cost effectiveness of sheet piles in general. The costs EPA uses ($2,750 per linear foot) would not be sufficient for water depths approaching 50 feet; these depths would require a much more expensive cofferdam type system. EPA also continues to show figures that depict sheet piling in greater than 50 feet of actual water depth, which is technically infeasible. (There continue to be mistakes in EPA's mapping of the appropriate water depths.) These figures also imply that sheet piles will be installed in the navigation channel, which would infeasibly obstruct vessel traffic. Sheet pile would also impact ongoing water dependent operations and nearshore fish migration. EPA does not consider the inability to remove contaminated material within the crenulations of the containment barrier and does not evaluate whether sheet piles in the navigation channel could be permitted by USACE.*

EPA Position:

Sheet piles are a representative engineered rigid control measure identified and evaluated for sediment dispersion control in the 2016 FS. However, that representative approach does not preclude other types of rigid control measures for consideration during remedial design. As stated in Appendix O, EPA agrees that depth can limit the use of suitable engineered options for controlling releases, and deep water depths can preclude the use of sheet piles. EPA assumes that engineered rigid containment will be utilized when NAPL was present in water depths less than 50 feet.

Engineered rigid control measures were evaluated holistically within the 2016 FS for their use in reducing or eliminating short-term releases of contaminants during construction and not on a location-specific basis. Thus, the 2016 FS does not present figures indicating design level logistical details regarding location and depth of engineered rigid control measures. Location-specific evaluations for feasibility of sheet pile versus other types of engineered rigid control measures, including placement within the navigation channel, were beyond the scope of evaluation of this 2016 FS. Details regarding sediment dispersion control and location-specific engineered rigid control measures will be determined during remedial design which is the appropriate time for those types of evaluations.

Alternative-specific costs for purchasing, installing and removing sheet pile walls are presented in Appendix G. The unit costs were developed by Anchor QEA in the draft 2012 FS on a horizontal linear foot basis. Quantities for sheet pile lengths used in the detailed alternative cost estimates and presented in the 2016 FS Appendix D Table D2.j (in horizontal linear feet) were holistically estimated for each alternative by encircling all PTW dredge and/or capped areas with silt curtains assumed for the remainder of dredged and/or capped areas.

Figure 3.4-33 of the 2016 FS presents areas of NAPL presence and Site bathymetry identifying water levels at the 50 feet MLLW. EPA acknowledges that the legend of Figure 3.4-33 should indicate that the darker shaded areas identify water depths greater than 50 feet MLLW, and the lighter shaded areas identify water depths less than 50 feet MLLW.

Remedial activities with the potential to restrict navigation in the harbor channel will be coordinated with the USACE during remedial design, including efforts to minimize sediment dispersion in areas where NAPL extends into the navigation channel. The Rivers and Harbors Act prohibits obstructions to navigation, but does not speak specifically to temporary obstructions, and CERCLA otherwise requires remedies to be protective of human health and the environment, and other federal statutes require measures to reduce impacts to ESA species or the aquatic environment as well. It was assumed in the 2016 FS that the review for compliance with the substantive requirements of the relevant ARARs will occur during remedial design. However, permits and related administrative approvals, as implied by LWG, are not required for onsite CERCLA remedial actions and would not necessarily prevent implementation of these measures.

Long-term effectiveness evaluations are qualitative and not grounded in scientific method. Rather than quantitatively evaluating long-term effectiveness (all evaluations are based on a time zero SWAC), EPA has added a new approach of evaluating alternatives using "interim targets," which are basically ten times above the PRGs, and then EPA compares post-construction risks to these interim targets for evaluating the "overall protection of human health and the environment" for each alternative. EPA hypothesizes that if alternatives meet these interim targets, it is reasonable to assume the PRGs will be met through subsequent natural recovery in 30 years. It is confusing for EPA to claim they cannot quantitatively estimate MNR and then decide that MNR will work in 30 years. EPA also estimates "residual risk" as the estimated risk if all PRGs are met (i.e., risk at PRGs). EPA evaluated long-term effectiveness using a "magnitude of risk" defined per EPA page 4-10 as the ratio of the post construction risk to the residual risk. EPA does not explain why this analysis is technically superior to either the LWG's effectiveness evaluations or its own prior evaluations in the August 2015 FS. Alternative I does not meet some of these interim targets, yet EPA still picks this alternative as the preferred alternative which seems logically inconsistent. Figure 4.2-6 shows that none of the alternatives even come close to the ten times PRG levels. The same is true with Figure 4.2-4 (except Alternative G) and with Figure 4.2-2 (except Alternatives F and G). These methodologies fail to evaluate remedy effectiveness on appropriate spatial scales (fish consumption and ecological exposure), they fail to assess near shore deposition, and they fail to acknowledge the time frame and feasibility of achieving PRGs given upgradient concentrations and remedial action time frames. EPA in fact states that Alternative H "achieves PRGs at the end of construction," which is incorrect, because the very low PRGs for many COCs are not achievable through active construction.

EPA Position:

Long-term effectiveness evaluation is quantitative and grounded in scientific method. Long-term effectiveness risk remaining at the site after response objectives have been met. Thus, the remaining risks are the risks from any contamination remaining on-site after PRGs are achieved. Those risks include the risks at the PRGs and the risk of exposure of any contamination that is confined in the Site. In the evaluation of long-term effectiveness, the residual risk for each RAO is provided on various spatial scales relevant to the exposure scenarios established in the BRAs. The Respondents provide no supporting documentation as to why they believe the spatial scales are inconsistent with BRAs. EPA also provided the magnitude of the post-construction risk to show how much risk was addressed through construction and how much would be addressed through MNR. EPA did not use interim targets in evaluating long-term effectiveness; interim targets were only used for the discussion of overall protectiveness. EPA established the interim targets as levels of risk that would be acceptable should RGs not be achieved in a reasonable time frame (within 30 years) and are based on uncertainty in the risk estimates. Since long-term effectiveness is conducted after the PRGs have been achieved, there is no need to evaluate near shore deposition or time-frames and feasibility to achieve PRGs. These are issues discussed in short-term effectiveness. EPA appreciates the opinion of the Respondents that PRGs for many COCs are not achievable through construction, but they have not provided any scientific evidence to support their opinion.

Respondents miss the point of using the interim metrics in the 2016 FS. In the absence of a predictive model for MNR, EPA had to have a way to compare the effectiveness of the alternatives. The interim measures were not meant as absolute measures, but the closer you were to achieving them, the more likely the use of MNR would achieve PRGs in a reasonable timeframe. Figure 4.2-6 of the 2016 FS presents post-construction infant HI. As stated in Section 4.1.2 of the 2016 FS, the interim metric was ten times residual HI of 132 (or 1,320), not ten times PRG levels. This interim metric is clearly achieved by all the alternatives. Respondent is correct in their assessment of Figures 4.2-4 and 4.2-2 and EPA came to the same conclusion in Section 4.3 of the 2016 FS. These three figures all represent RAO 2, which is the fish consumption pathway, and was conducted site-wide consistent with the BHHRA. These figure do not represent residual risk for other RAOs; those are found in other figures and tables presented in Section 4 of the 2016 FS.

It is not the place of the FS to discuss why a technical analysis conducted in one FS was superior or another analysis conducted was inferior. The FS provides the technical analysis selected by EPA, whether it was developed by LWG or by EPA. EPA could not use the LWG's analysis of effectiveness in their 2012 FS for the following reasons:

PRGs are not consistent with the final baseline risk assessments

PRGs were not developed for all COCs posing risk

The residual risk evaluation uses the QEAFATE model, which EPA cited many deficiencies and did not approve

The evaluation did not calculate risk, but only compared residual sediment concentrations to PRGs

Residual risk was not quantified

Background values used were inconsistent with the 2015 dispute decision.

EPA did not select a remedy in the FS; remedy selection is conducted first in the Proposed Plan and then considering public comments and finally documented in the ROD. Therefore, the basis of EPA selecting a remedy is not a subject of this dispute.

The Monitored Natural Recovery (MNR) evaluation is insufficient to support the alternatives evaluation. The FS continues to omit key components of an MNR evaluation as required by guidance including: 1) an adequate CSM; 2) appropriate evaluation of multiple lines of empirical evidence; and 3) a quantitative evaluation of natural recovery and the associated long-term (i.e., after "time zero") outcomes of the alternatives. New concerns with the June 2016 FS include:

EPA added new information on bathymetry changes and fish tissue. In Section 3.6.1.3, EPA's updated evaluation of fish tissue concentrations over time completely ignores 2002 data without any explanation, and incorrectly evaluates data from 2007, 2011, and 2012. EPA should not combine temporally disparate data to establish baseline conditions.

EPA Position:
EPA guidance *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (USEPA 2005) Section 4.4 discusses the evaluation of MNR. The key components of an MNR evaluation that the LWG claims is required by guidance is not found in this guidance document. The information LWG claims is omitted from the 2016 FS is discussed below:

1) An adequate CSM. The assertion that there is an inadequate CSM is both subjective and confusing. The RI, over the course of thousands of pages develops and presents the CSM. The feasibility study conducts additional analyses of the RI and other data in the context of remedial alternative development and evaluation.
2) Appropriate evaluation of multiple lines of empirical evidence. A full evaluation of multiple lines of empirical evidence for natural recovery is provided in Appendix D.8 of the 2016 FS.

A quantitative evaluation of natural recovery and the associated long-term (i.e., after "time zero") outcomes of the alternatives. Outcomes greater than t=0 are not quantitatively evaluated using, for example, large, complex linked hydrodynamic, sediment transport, contaminant transport, and foodweb bioaccumulation modeling based on additional models of the effect of remediation because the results are not quantitatively accurate and absolute or relative comparisons among quantitatively inaccurate outcomes, is not helpful. Such evaluations are not "required by Guidance." However, quantitative evaluations of empirical data (trends in sediment deposition and fish tissue concentrations), where available, were undertaken. An evaluation of temporal trends (of any media) requires consistent collection methodology over the evaluated time period. The data also need to be able to indicate the processes that are being evaluated.

The 2002 fish tissue effort collected and composited individual fish from both sides of the river. The 2007 fish tissue effort composited samples from only one side of the river; thus, it is not appropriate to compare those data to the 2002 data. While the 2002 data may be relevant for risk assessment purposes (assuming a fisherman eats fish from both sides of the river), it obscures known site/source signatures that are on one side of the river. Evaluating trends of a group of fish collected and composited from both sides of the river is counter to the CSM and what is known about the localization and transport of contamination, so the 2002 data were not further used to evaluate changes in contamination. The 2011 and 2012 samples were analyzed as individuals and are not biased by the compositing issue. EPA did not "combine temporally disparate data." EPA analyzed the data for 2007, 2011, and 2012 for changes over time to see whether a natural recovery trend in fish tissue concentrations could be discerned.

EPA states that, "a minimum deposition rate of 2.5 cm/year was assumed as the criteria [sic] for effective MNR." This criterion is obviously not used by EPA in the FS because the FS assumes MNR as the applicable technology for all areas outside SMAs (as opposed to applying MNR in just areas exceeding the minimum deposition rate). While deposition is a mechanism of natural *recovery, there are other mechanisms occurring at this site. These mechanisms include biotic and abiotic transformations that remain unevaluated leaving the CSM incomplete. Further, the assumption of 2.5 cm/year as a criterion for natural recovery in the absence of a coherent CSM is without justification or merit. EPA has added some text that implies effectiveness is related to "mass removal" of contaminants. Page ES-15 states the advantage of Alternative H is that "it removes more contamination." Guidance is clear that mass removal is not an appropriate way to evaluate sediment remediation alternatives; rather the evaluation must address reduction in risk.*

EPA Position:

EPA disagrees that the bathymetry data clearly show that net deposition occurs over large portions of the lower Willamette River during the overall multi-year period (2002 to 2009). In the LWG's 2012 draft FS, Section 2.1.2, p.2-3 states:

> Over the period from July 2003 to January 2009, the Study Area was 88 percent depositional or showed no substantial change.

EPA disagrees that areas that areas that score neutral (no substantial change) are depositional since there is no accumulation of sediment in those areas of the Site. This line of evidence was used in the analysis of MNR in the 2016 FS (see Appendix D8), and the conclusion was that very little area of the site is depositional and the majority of the Site is neutral (transitional).

Regarding the statement "Therefore, a minimum deposition rate of 2.5 cm/year was assumed as the criteria for effective MNR.", the referenced text is in Section 3.6.1.2 "Sediment Deposition Rate," where the sediment deposition rate is positioned as one natural recovery line of evidence. The 2016 FS, Section 3.6.1, clearly states:

> For the purposes of the FS, it is expected physical isolation through natural deposition of cleaner material and dispersion and mixing are the primary mechanisms for natural recovery at the Site.

Further, this criteria was not the only criteria used in the analysis in Appendix D8. Thus, the sentence in question should have stated:

> Therefore a deposition rate of 2.5 cm/yr was used to indicate whether areas were depositional.

The 2016 FS (p. 134) describes mechanisms of natural recovery as: "Natural recovery typically uses ongoing, naturally occurring processes to contain, destroy, or reduce the bioavailability or toxicity of contaminants in sediment. These processes may include physical (sedimentation or dispersion), biological (biodegradation), and chemical (sorption and oxidation) mechanisms that act together to reduce the risks posed by contaminants." The CSM in the RI acknowledges that biological and chemical mechanisms occur in the Site as does the 2016 FS; thus, the CSM is complete. However, the LWG used literature values in the RI report (section 6) to discuss degradation rates. The LWG did not collect data to quantitatively evaluate these mechanisms.

The evaluation that included the 2.5 cm/year criterion was useful in further developing the CSM (which is described in the RI), concluding that:

> The survey pairs range from generally erosional, to stable, to depositional between sequential survey pairs. This figure illustrates the dynamic nature of the sediment bed and the uncertainty associated with the conclusion that elevation changes between two surveys progressed evenly over time. This type of sediment bed behavior may also influence natural recovery: the process of burial would be interrupted during erosive periods, but dispersion would increase, if contaminated sediment was eroded…. This analysis indicates that most of the Site is in dynamic equilibrium where both erosion and deposition occur. In many areas of the Site, the determination of deposition and the assertion that burial is a viable long-term recovery mechanism is largely dependent on which survey pair is selected. (2016 FS p. 3-34)

The statement that "it removes more contamination" is not synonymous with the connotations regarding "mass removal." Remedial alternatives in the FS were developed based on contaminant exposures at the sediment surface that drive risk to receptors and the alternatives were compared and evaluated on the basis of risk metrics.

The 2016 FS addressed the issues the LWG raised in their LWG List of Significant Issues with EPA's Revised FS Sections 3 and 4 (September 8, 2015), Issue 8, pages 19-22. An analysis of MNR using multiple lines of evidence, many similar to those used by the LWG in their 2012 FS, is contained in Appendix D8 of the 2016 FS. The LWG did not provide specific concerns with Appendix D.

Further, EPA believes that the LWG's analysis of the fish tissue data is flawed. The LWG, with assistance from CAG representative Bill Egan and other local fishermen, collected small mouth bass tissue in the lower Willamette River in the fall of 2012. The data provide a snapshot of the current levels of PCBs in tissue in the Portland Harbor area and an area upstream of the Superfund Study Area. One of the objectives of the data collection was to help EPA establish a baseline in fish tissue that can be used for comparison with future monitoring results to see if levels or trends expected from the cleanup of contaminated sediments can be achieved. Fish tissue data was also collected in 2002 and 2007.

EPA's observations of these data include:

> PCB concentrations in bass tissue collected in Portland Harbor remain above those that would be considered protective for people eating these fish.
>
> While some of the results indicate that PCB concentrations have decreased compared to 2007 data, fish caught in areas of Portland Harbor that showed the highest levels of contamination previously are still well above acceptable levels. The highest levels were from fish caught in the area known as RM 11E, one of the areas with the highest levels of sediment contamination. However, the inherent degree of variability in biota concentrations preclude drawing any firm conclusions based on the limited data.

Although it is premature to draw firm conclusions, decreases in some of the tissue levels compared to the 2007 data may be attributed to improving conditions from ongoing source control work, some natural recovery from cleaner material from upstream being deposited in sediments in the lower harbor, or simply variability in the data. Future monitoring will be needed to confirm whether levels will continue to trend downward.

Although it appears that some natural recovery is taking place, EPA believes that a combination of approaches, include active cleanup methods like dredging, capping, treatment, and other methods to enhance and accelerate natural recovery, will be needed to achieve significant risk reduction for people who are eating resident fish from Portland Harbor.

EPA agrees that the results of the 2012 fish sampling displayed a general trend of lower concentrations, with the notable exceptions of RM 9W and 11E. However, the 2007 data represent composites of 5 fish collected where they were most easily caught over a river mile, while the 2012 data represents individual fish caught from specific locations. The data are not directly comparable, and two somewhat similar sampling events aren't sufficient to establish a reliable trend.

Two fish collected from RM 16 contained noticeably greater PCB concentrations than other fish collected from the reference area. Sediment data collected at RM 16 during the LWG's background study revealed that PCB concentrations in sediment an order of magnitude greater than typical concentrations measured in the background data set, indicating the presence of a possible contaminant source or hot-spot. When data from the two fish with the highest PCB concentrations are excluded from the reference area data set, data from the site displays a trend of concentrations noticeably greater than background. The areas that display the highest PCB concentrations in fish tissue are consistent with the areas where the highest concentrations were observed in the 2002 and 2007 sampling efforts, and consistent with the trend that individual, discrete areas of Portland Harbor exhibit obvious PCB contamination.

Issue 8. Discussion and Analysis of Monitored Natural Recovery Is Biased – The MNR evaluation includes text scattered across Sections 3 and 4. The overall MNR evaluation presented across these two sections is very limited and technically inappropriate in many respects. Overall, EPA suggests that MNR is potentially appropriate for the Site with many caveats and doubts expressed in that assessment. In actual fact, the case for MNR at the Site is strong given that there are multiple lines of evidence supporting the ongoing occurrence of MNR well in excess of the lines of evidence presented by EPA. The simplistic MNR analysis in Sections 3 and 4, appears to cast doubt on the validity of MNR as a potentially feasible process for the Site, which is a misleading representation of the data.

In Section 3, EPA presents a very simplistic MNR analysis, which generally assumes that MNR will take place outside any active remediation areas based on: 1) surface to subsurface sediment concentration ratios; and 2) a simple deposition rate calculation using two of the time series bathymetry datasets. In Section 4, EPA slightly expands upon the evaluation of MNR, including a different analysis of the time series bathymetry, a brief discussion of maintenance dredging history as an indication of deposition, and a *perfunctory discussion of the 2012 smallmouth fish tissue PCB data. Generally, it is unclear why there are two separate and somewhat conflicting MNR evaluations spread across these two sections, particularly given that neither section references the other. EPA's analysis does not include the full lines of evidence strongly supporting the presence of ongoing natural recovery at the Site. The LWG has provided this information in past submittals to EPA including the 2012 draft FS, a detailed presentation of smallmouth bass fish tissue concentrations (Anchor QEA 2013), and estimated equilibrium levels for the Site (LWG 2014d, 2014g).*

EPA Position:

This comment pertained to EPA's 2015 draft FS, not the 2016 FS. In the 2016 FS, Section 3.6 discusses MNR and presents three lines of evidence for MNR: incoming sediment particles (sediment traps and suspended solids), sediment deposition rates (bathymetric pairs), and fish tissue concentrations (2007, 2011, and 2012 sampling events). Section 4 of the 2016 FS discusses that a fate and transport model cannot be used for this Site in Section 4.1.2 and states that the evaluation in Appendix D8 will be used to evaluate each alternative with respect to the ability for MNR to achieve cleanup goals in a reasonable time frame after construction activities are completed. Appendix D8 of the 2016 FS uses six lines of evidence to conduct this evaluation: (1) deposition and erosion rates; (2) consistence of deposition and erosion using bathymetric pairs; (3) sediment grain size; (4) anthropogenic factors; (5) surface to subsurface sediment concentration ratios; and (6) wind and wake generated waves.

In summary, the lines of evidence for ongoing natural recovery at the Site are:
• Sources are being progressively controlled. DEQ's latest source control report (DEQ 2014) indicates DEQ has completed source control evaluations and implemented (or will implement) controls on one or more potential pathways at approximately 119 of 168 sites examined in detail to date.

EPA Position:

While it is important that sources of contamination are controlled at the Site to ensure MNR will be effective, controlling sources is not a line of evidence that MNR is occurring in various areas of the Site.

• The aggregate information from five multi-beam surveys indicates widespread deposition of sediments across many areas of the Site. Although EPA emphasizes the uncertainties of the data, for reasons detailed below, the LWG disagrees these data present substantial uncertainties about deposition.

EPA Position:

See EPA's position on p. II-54.

• Sediment trap and suspended sediment data clearly show that incoming settling sediment has substantially lower contaminant concentrations than most of the Site bedded sediment, which will drive bedded sediment concentrations lower over time.

EPA Position:

EPA agrees and included this line of evidence in the 2016 FS, Section 3.6.1.1.

• Radio-isotope coring data, although limited, indicates deposition rates consistent with other measures such as the bathymetry time series.

EPA Position:

The LWG conducted radioisotope sampling on 4 cores to a depth of 90 cm and analyzed for ^{7}Be, ^{137}Cs, and ^{210}Pb. The results are presented in the *Draft Monitored Natural Recovery (MNR) Technical Memorandum – Step 2 Data Evaluation Methods* provided in Appendix A5 of the final RI Report. The report provides the following information:

> The ^{7}Be activities were undetectable at every station except one and detectable concentrations were only in the upper 5 cm.
>
> The ^{210}Pb profiles at the sampled stations did not show the exponential decay profile normally exhibited in a quiescent depositional environment. Evaluation of the data indicates that although no apparent decay trends exist for stations NA-3 and NA-4, stations NA-1 and NA-2 showed a general decay trend with depth. The downward trends in ^{210}Pb concentrations in two cores and the generally low ^{210}Pb concentrations in all cores suggest a much more dynamic sedimentation environment than assumed by simple application of the CRC or CIC models. Such profiles are indicative of sediment systems that have large amounts of gross sedimentation and gross resuspension.
>
> Stations NA-2, 3, and 4 showed peak ^{137}Cs activities (0.13 to 0.37 pCi/g) within the top 5 cm of the cores and attained an approximate baseline activity at 0.05 pCi/g at deeper depths. Station NA-1 showed a consistent activity matching the baseline activity (0.05 pCi/g). In environments where the assumptions of the CRM and CIC Models are accurate, these peaks are highly correlated with the peak in nuclear arms testing in 1963. Therefore, under these assumptions, the exposed surface sediment layer is indicative of the 1963 surface.

Based on this information, EPA disagrees that the radioisotope cores indicate any useful information regarding deposition rates.

• Site surface sediment grain sizes are fine-grained across the majority of the Site, strongly indicating a long term depositional environment exists in these areas.

EPA Position:

While EPA agrees that sediment grain size is a useful line of evidence and used that information in the 2016 FS, Appendix D8, EPA disagrees that only surface sediment grain size should be used and that the majority of the Site has fine grain size (see 2016 FS, Figure 2.2-1).

• Surface to subsurface sediment concentration ratios in most areas of the Site indicate newer surface strata contain lower concentrations than older subsurface strata, which illustrates that surface sediment concentrations are decreasing over time.

EPA Position:

EPA agrees and included this line of evidence in the 2016 FS, Appendix D8.

• Surface sediment concentrations measured over time (i.e., time series) indicate surface sediments have decreasing contaminant concentrations. The 2012 draft FS data are somewhat limited, but new PCB data collected in 2014 by other parties may provide additional useful information for this line of evidence.

<u>EPA Position</u>:
While EPA agrees that sediment time-series data would be useful in establishing MNR trends, no such data exists. The 2014 data that the Respondent refers to was not conducted in manner statistically comparable to the baseline data set and cannot be used to establish a trend. Further, many more years of information need to be collected to understand the MNR trends in sediment as they fluctuate from year-to-year. Further, the quality of the data collected in 2014 is questionable since it was not conducted under an EPA approved QAPP or work plan.

• Smallmouth bass PCB tissue measurements made in 2002, 2007, and 2012 indicate statistically significant declines in tissue concentrations across almost all areas of the Site (Anchor QEA 2013). Differences in sampling and compositing schemes across the years can be controlled to determine statistically valid results.

<u>EPA Position</u>:
While EPA agrees that the smallmouth bass PCB tissue concentrations from 2007, 2011 and 2012 indicate some information about MNR at the Site, there is insufficient data to statistically compare this data. **[AR Doc # 100033469]** EPA does not believe that the 2002 data set can be compared to these other data sets (see EPA positions on p. II-52 and II-54 and EPA position to LSS Issue 5).

• Comparisons of sediment profile images collected in 2001 (by the LWG) and 2013 (by other parties) indicate that much of the Site now has well established Stage 3 benthic communities indicative of stable and recovering substrates.

<u>EPA Position</u>:
Stage III populations are late successional stage populations, meaning that the benthos has had some time to recolonize a disturbed area (or have not been disturbed), have the greatest number of species, and have species that burrow and feed as deep in the sediment as site conditions permit. Benthic populations in river miles 7.0 to 9.7 and 3.0 to 5.1 were mostly classified as Stage III populations in the 2002 SPI survey. The 2002 SPI survey did not include areas between RM 1.9 and RM 3.0 or between RM 9.7 and RM 11.8. Therefore, it would be hard to make a case that the health of benthic populations has substantially improved between 2002 and 2013, based solely on SPI data. The Respondent does not provide the comparison of the areas they believe have established Stage III populations where they did not exist before. Further, the 2013 SPI survey collected by other parties was not conducted under an EPA approved work plan or QAPP and EPA is concerned about representativeness of information.

• Simple modeling (such as EPA's SEDCAM modeling, which was not provided in Section 3 or 4) and complex modeling (such as the 2012 draft FS QEA FATE model and coupled dynamic Food Web Model) all generally indicate recovery of surface sediments over a reasonable timeframe toward a relatively consistent range of potential equilibrium levels.

<u>EPA Position</u>:
There are no models available to predict MNR for the Portland Harbor Site. As stated in the 2016 FS, Section 4.1.2, EPA reviewed the predictability of the 2012 draft FS QEA Fate Model and found its predictability poor. EPA also did not use the SEDCAM model as it only predicts deposition, not erosion, and is thus inconsistent with the conceptual site model.

> *Specific issues relevant to the EPA Section 3 and 4 MNR evaluations include:*
> *a. In Section 3, EPA's MNR text starts by discussing that MNR is not usually selected as a "stand-alone" technology per guidance. Although this is consistent with guidance, neither the LWG nor EPA proposes to use MNR as a stand-alone remedy. The Section 3 text then goes on to list a series of cautions and conditions about MNR in bullet points, apparently intended to support the opening contention that MNR is not a good stand-alone remedy.*
> *Further, some of the conditions noted in the bullet points as conducive to natural recovery are actually present or strongly indicated in Portland Harbor. Therefore, the purpose of this discussion in light of EPA's selection of MNR as a component of all alternatives is unclear and should not be relied upon to undermine the substantial evidence supporting MNR as a major component of the overall remedy.*

<u>EPA Position</u>:
This information is presented to inform the reader of the information needed to select MNR as a viable technology. EPA then goes on to discuss how Site-specific information was considered and MNR technology is viable at the Site. EPA disagrees that the information presented undermines the selection of MNR at the Site.

> *b. EPA's Section 3 discussion of surface to subsurface sediment chemical concentration ratios within the Site is misleading. For example, EPA uses a surface to subsurface ratio of 0.5 (which is more conservative) to indicate likely MNR, whereas the 2012 draft FS uses a ratio of 0.67. EPA does not discuss the rationale for the selection of this more conservative ratio, or why it leads to any more valid conclusions about natural recovery at the Site.*

<u>EPA Position</u>:
The 2016 discusses surface to subsurface sediment concentration ratios in Appendix D8, not is Section 3. A subsurface-to-surface ratio of 2 and 10 were both used in the evaluation. The Respondent does not provide why they believe that using a ratio of 0.67 (or 1.5 subsurface-to-surface ratio) is more appropriate than the evaluation provided in the 2016 FS. At lower contaminant concentrations, it is very difficult to discern with any confidence the difference between a ratio of 1.5 or 2. For this reason, EPA added the evaluation using a ratio of 10. EPA did not use the LWG's ratio of 1.5. This number is based on site-wide averages of surface and subsurface data and then compared to obtain a ratio, which was 1.5. While this information provides a general depiction of the site as a whole, EPA was interested in whether MNR was viable in particular areas of the Site. A ratio of 1.5 is too small to discern whether or not MNR is working in areas with lower contaminant concentrations, which is where EPA intended to use the technology.

c. EPA's Section 3 discussion of deposition rates within the Site is misleading.
EPA appears to have ignored the LWG's comments in October 2014 where the LWG described differences in the definition of areas that are "reliably depositional." EPA continues to use the "typical bathymetric survey measurement error" of 6 inches or 15 cm (which equates to 2.5 cm per year (cm/yr) over the period of 2002 to 2009) to define areas that are reliably depositional. Measurement error in a bathymetric survey is a random error (i.e., there is no bias) with an average value of 0 cm for many measurements.
These data are normally distributed, so that a 15-cm measurement error is a very rare occurrence (e.g., at the 3-sigma level, which has a probability of occurrence of less than 1% for a single measurement). Thus, EPA's use of a +15-cm measurement error at a single location (10-foot grid) to specify the 2.5 cm/yr deposition threshold is extremely conservative. Further, evaluating and interpreting bed elevation changes on a 10-foot grid is not appropriate due to inherent measurement uncertainty at this small spatial scale. Averaging bathymetry data over larger spatial scales provides a more reliable method for analyzing bed elevation changes because the effects of measurement error on the results decrease as the spatial scale increases. This approach was used by LWG in the 2012 draft FS to analyze bed elevation changes over a wide range of spatial scales in the Lower Willamette River.
The uncertainty in EPA's analysis results can be significantly reduced simply by averaging the bathymetry data over slightly larger spatial scales. For example:
i. Using a 20-foot grid (i.e., averaging of four data points from the 10-foot grid) would reduce the measurement uncertainty by a factor of 2 (i.e., +7.5 cm), which would reduce the deposition threshold to 1.25 cm/yr.
ii. Using a 30-foot grid (i.e., averaging of nine data points from the 10-foot grid) would reduce the measurement uncertainty by approximately a factor of 3 (i.e., +5 cm), which would reduce the deposition threshold to about 1 cm/yr.
Thus, using the data over appropriate spatial scales, it can be reliably determined that areas experiencing more than 7.5 cm of deposition over the 6-year period between 2003 and 2009 are depositional (equating to 1.25 cm/yr).
This difference between EPA and LWG's approach results in a large change in the amount of Site area characterized as reliably depositional (the LWG method results in 63%; the EPA method results in 47%).

EPA Position:
Appendix La of the 2012 Draft FS (p. 37) states that the typical survey measurement error range is 0.5 feet, resulting in an uncertainty range of 1 foot for bed elevation changes between two surveys. The uncertainty range in one direction (i.e., depositional) would be 6 inches, which equates to roughly 1 inch (2.5 cm) per year for the period between the 5/2003 and 1/2009 surveys. Therefore, the depositional criterion EPA is using assesses deposition that can reliably be detected using the available survey data. This information was provided to the LWG in a meeting on June 5, 2014, and again in an email on October 21, 2016. **[AR Doc # 100010336]**

There is an engineering "rule of thumb" that "When measurements add, their errors (uncertainty) add. When measurements multiply their relative errors add." In order to average a series of values, the values are first summed and then the sum is divided by the number of values. When there is error associated with the values, the error of the average value is derived using the same formula: the error associated with each value in the series is summed and then the sum of the error is divided by the number of values. The Respondents neglected to sum the error with each value and thus erroneously concluded that somehow averaging the area over larger footprints would lessen the error. However, averaging errors does not reduce the error in the measurement and, thus, the error is still the same for the average. Consequently, averaging over larger grids does not affect the uncertainty in the measurement.

d. In Section 4, EPA uses a different approach that biases results when evaluating temporal changes in bathymetry data between 2002 and 2009 and is inconsistent with recent Sediment Erosion and Deposition Assessment (SEDA) guidance (Hayter et al. 2014). EPA concluded that "many areas of the site are in dynamic equilibrium" and "for many areas of the site, the determination of deposition, and the assertion that burial is a viable long-term recovery mechanism, is highly dependent on which survey pair is selected."

Generally, temporal changes in the Lower Willamette River (LWR) bathymetry (and similar river systems) are dynamic, with alternating periods of gross deposition and erosion occurring in localized areas. The bathymetry data clearly show that net deposition occurs over large portions of the LWR during the overall multi-year period (e.g., 2002 to 2009) examined as discussed in Comment 8c above. The net deposition process during a multiyear period does not typically correspond to steady continuous deposition; net deposition is due to a cumulative increase in bed elevation that results from alternating periods of deposition and erosion, with gross deposition being greater than gross erosion over a long period. This is not a surprising or unusual finding for this or similar river systems. Consequently, EPA's emphasis on comparisons between various individual pairs of bathymetry surveys ignores the overall trends represented by the bathymetry series as a whole. The FS is also misleading regarding the uncertainty of this information, given these dynamic sedimentation processes are routinely evaluated at sediment remediation sites using time series bathymetry data.

Such routine methods are used in the 2012 draft FS and are consistent with the most recent guidance (Hayter et al. 2014). EPA does not reference this guidance in the Section 3 or 4 bathymetry discussions.

<u>EPA Position</u>:

In the 2016 FS, Appendix D8, EPA uses the comparison between the January 2002 and January 2009 bathymetry surveys as one line of evidence for MNR and a comparison between each of the bathymetry surveys as another line of evidence. The first gives an overall understanding of deposition and erosion in the long-term. As stated by the Respondent, temporal changes in the Lower Willamette River (LWR) bathymetry (and similar river systems) are dynamic, with alternating periods of gross deposition and erosion. Thus, comparing all the bathymetric pairs provides information regarding where there is consistent deposition or erosion and where there is alternating deposition and erosion.

e. In Section 4, EPA devotes one paragraph to a discussion of the 2012 smallmouth bass tissue PCB data. EPA indicates that an "exact comparison" between 2002, 2007, and 2012 smallmouth bass tissue data is not possible because the "sampling and compositing schemes vary between years." The LWG provided a detailed presentation to EPA in March of 2013 comparing the tissue data across these years, including several types of *statistical tests and other trend comparisons (Anchor QEA 2013). That LWG presentation showed that, in many respects, the differences in sampling and compositing across sample years can be controlled to obtain statistically meaningful information regarding clear declines in fish tissue PCB concentrations. EPA included in Section 4 the single most simplistic graph from the start of the LWG's presentation, which was intended to merely summarize the data that are available, not demonstrate observed declines. EPA concludes from this one misused graph that the data are only "suggestive of declines." The text ignores all of the other detailed information and graphs available that more clearly show the tissue PCB declines, and EPA ignores all of the statistical analysis provided by the LWG. Consequently, EPA substantially understates the role of these data as a strong line of evidence for the effectiveness of MNR at the Site.*

<u>EPA Position</u>:
See EPA Position on p. II-54.

<u>LWG Dispute Issue 2c:</u>
EPA's PTW approach is inconsistent with guidance and fails to result in reduction in toxicity, mobility or volume of hazardous substances commensurate with its extraordinary projected cost. As discussed in detail in the LWG's prior comments, EPA has designated as PTW large geographic areas with relatively low concentrations of contaminants of concern based primarily on its evaluation of the human health fish consumption criteria, which is an exposure pathway not based on highly toxic criteria and not typically used for PTW "highly toxic" designations. The conclusion that this exposure pathway should not be the basis for a PTW designation is corroborated by 2012 fish tissue data, previously shared with EPA, that show PCB concentrations in fish tissue have declined significantly resulting in human health risks that are likely to be lower than 10-3. The FS fails to satisfactorily explain how sediments in these large areas are highly mobile or highly toxic and cannot reliably be contained in place. For example, the FS does not explain or justify why sediment at the relatively low concentration of 200 ppb PCBs is "highly toxic," which is generally defined as a concentration several orders of magnitude above levels that allow for unrestricted use and unlimited exposure. At many other large sediment sites around the country, EPA's cleanup level for total PCBs is 1 part per million. The level requiring special disposal under TSCA is 50 ppm (50,000 ppb). Sediment at 200 ppb PCBs is well below what is considered an acceptable cleanup level at these other sites. And, as discussed above, EPA's recalculated site-wide PCB SWAC of 208 for Alternative A (No Action) used in Table J2.3-1a of Appendix J for the residual risk assessment exceeds this arbitrary PTW threshold, undermining the usefulness of the concept as a balancing criteria or otherwise.

The June 2016 FS includes new explanations that further show that EPA's PTW approach is inconsistent with guidance and flawed. For example, EPA states, "'Reliably contained' was not used in identifying PTW but rather was used to determine what concentrations of PTW could be reliably contained." This clearly contradicts the guidance, which discusses "reliably contained" as part of PTW identification.

EPA should not identify materials that can be reliably contained as "principal threat waste." EPA admits (in Table 3.2-2) that all COCs at the concentrations present in the site, with just two exceptions-- chlorobenzene and naphthalene, can be reliably contained. Thus, none of the areas where these contaminants are absent should be designated as PTW. Blanket identification of *large areas of relatively low concentration sediments as PTW is neither required by the NCP nor necessary to protect public health or the environment.*

Similarly, the June 2016 FS provides no discussion or explanation of how material with sediment concentrations above the EPA-identified "highly toxic" thresholds or the presence of "globules or blebs" of Non-Aqueous Phase Liquid (NAPL) pose risk of contaminant migration. Further, EPA's PTW-NRC footprint is mapped very differently in the FS and Proposed Plan, showing that, even at this late date, EPA has not spent adequate time evaluating this issue.

46 See, e.g., LWG List of Significant Issues with EPA's Revised FS Sections 3 and 4 (September 8, 2015), Issue 2 and page 8.

> *Issue 2 Principal Threat Waste – The LWG previously commented (LWG 2014c) that a precise identification and highly quantitative evaluation of PTW at the Site is not necessary or productive for completing the revised FS and is not necessary for EPA's selection of a remedial alternative. Per those past comments, EPA's proposed PTW approach is inconsistent with guidance on PTW (EPA 1991) in several respects. The LWG disagrees with EPA's logic and approach for determining PTW.*
> *First, EPA uses fish consumption scenarios to determine "direct" cancer risk highly toxic thresholds in excess of 10-3. Before applying such thresholds for PTW identification, the presence of actual risks greater than 10-3 needs to be determined. In fact, greater than 10-3 risk was not found in the EPA-approved Baseline Human Health Risk Assessment (BHHRA) for dioxin/furan TEQ, total DDx, or BaPEq for any scenario evaluated.*
> *Therefore, the definition of highly toxic as described by EPA (1991) is only potentially applicable to total PCBs. Second, as described in LWG's past PTW comments (LWG 2014c) greater than 10-3 cancer risk was found for PCBs in the BHHRA for three fish consumption scenarios: subsistence (mixed diet, fillet), recreational (mixed diet, fillet), and tribal (whole body and fillet). But EPA guidance (1991) describes PTW materials as a source for "direct exposure." The fish consumption pathways are, by definition, indirect pathways from sediment through fish to people, and these pathways do not represent "direct" exposures from sediment contaminants as described in the guidance. See the LWG's 2014 PTW comments for more details on this issue (LWG 2014c).*
> *Third, the point-by-point application of EPA's highly toxic thresholds is entirely inconsistent with the spatial and temporal scales associated with this indirect exposure as described in the BHHRA. This includes that people catch fish over multiple areas and fishing events and that the fish range across different areas during those timeframes.*
> *Fourth, EPA uses inapplicable and inferential evidence to identify potentially highly mobile (i.e., NAPL) material in a manner that is inconsistent with the intent of the PTW guidance. The highly mobile aspect of the PTW definition should be applied for NAPL consistent with situations described in the guidance (EPA 1991), such as "pools of NAPLs submerged beneath ground water or in fractured bedrock, NAPLs floating on ground water" or where physical processes are likely to mobilize "source materials" as defined in the guidance. EPA's identification of any potential NAPL as PTW is inappropriate and inconsistent with the guidance. For example, EPA identifies solid tar materials at Gasco as analogous to highly mobile liquids, which the guidance defines as "liquids and other highly mobile materials (e.g., solvents)." Also, at the Arkema Site,*

continuous cores have been visually logged and hundreds of samples have been analyzed at the laboratory and, to date, no chlorobenzene NAPL has been found in Arkema sediments. EPA also uses any visual trace observations of NAPL, such as "blebs and globules," to identify highly mobile PTW. This approach is clearly inconsistent with the terms used in the guidance, such as "pools of NAPLs" as quoted above. See LWG 2014c for more description of how EPA's highly mobile PTW approach is inconsistent with the PTW guidance.

Also, EPA's PTW approach is inconsistent with the approach taken at other large river sediment remediation sites, including EPA's recent Region 10 ROD for the Lower Duwamish Waterway, where the maximum sediment PCB concentration was 220 mg/kg. Nonetheless, EPA determined the Duwamish sediments are generally "low-level threat waste" (EPA 2013). In comparison, at Portland Harbor, the maximum PCB concentration is 36 mg/kg, and EPA is identifying concentrations of 0.2 mg/kg as PTW. The LWG's PTW comments (LWG 2014c) review the PTW approach at five other large sediments sites, mostly with much higher contaminant levels than Portland Harbor. All of those sites also do not identify specific PTW areas in the FS process.

Additional specific issues related to the PTW text in Section 3 include:

a. EPA defines areas as PTW without including the reliably contained step of the evaluation described in the NCP and guidance (EPA 1991). Without the reliably contained evaluation included, these areas cannot be appropriately defined as PTW. In other words, only the areas that EPA designates as "not reliably contained PTW" have the potential to actually be defined as PTW.

See NCP Preamble, 55 FR 8666 at 8703 (March 8, 1990): "Principal threats are characterized as waste that cannot be reliably controlled in place, such as liquids, highly mobile materials (e.g., solvents), and high concentrations of toxic compounds (e.g., several orders of magnitude above levels that allow for unrestricted use and unlimited exposure)."

b. EPA's not reliably contained analysis using the so called "super cap" approach is also technically incorrect. EPA uses generalized Site-wide groundwater seepage rates for the super cap analysis rather than more localized estimates available in the RI. Further, groundwater control systems exist at both Gasco and Arkema sites, which EPA states were not considered in the analysis. For example, at the Gasco site, the groundwater source control system has been shown to cause negative seepage (i.e., movement of river water down into the sediment bed) over broad areas of the offshore sediments, but EPA's super cap analysis assumes that positive groundwater seepage out into the river is still occurring. Using appropriate seepage parameters where groundwater source control systems exist would result in no identification of not reliably contained material at the Gasco site. A similar analysis is appropriate for sediments offshore of the Arkema site, which has installed a slurry wall and a groundwater extraction and treatment system designed to prevent migration from the uplands to the river. EPA should consider the specifics of that groundwater control system, as well as other areas with significantly lower than average groundwater gradients (e.g., RM 2-4 East).

c. EPA's PTW approach results in large relatively low concentration areas of the Site being identified as PTW. For example, large PTW areas exist outside much of the SMA footprint of the smaller alternatives (e.g., Alternatives B and C), which is a unique circumstance for a sediment FS as far as we are aware. Further, the concentrations that EPA is proposing as PTW would beconsidered completely safe under other common *remedial and regulatory scenarios. For example, EPA's PTW level for PCBs of 200 μg/kg is below EPA's Regional Screening Levels (RSL) for residential soil, which range from 230 to 3900 μg/kg (per EPA's June 2015 RSL residential soil table carcinogenic risk values for total PCBs). DEQ's risk-based residential soil cleanup standard for PCBs is 200 μg/kg. Although EPA indicates that PTW is only a "preference" for treatment, EPA's decision trees indicate that PTW is almost always subject to treatment including reactive armored caps, reactive residual cover layers after PTW is removed, in situ treatment, or ex situ treatment after removal and before disposal. Regarding ex situ treatment, EPA determines that any PTW that is based on NAPL (including trace observations per above) and PTW related to cPAHs or DDx must be ex situ treated. Essentially, the only situation where removed PTW does not need to be ex situ treated is for high concentration materials above the PCBs and dioxin/furan PTW thresholds. EPA's PTW approach contributes substantial ex situ and in situ treatment components to both removal and in-place technologies for all alternatives both inside and outside of SMAs, as well as extensive sheetpiles (and associated costs) for removal in some areas. For example, Alternative B involves ex situ treatment of 240,840 to 321,120 cubic yards (cy) of sediment, which is about 39% of the total volume removed under this alternative.4 (Although EPA orally indicated on August 27 that much of this volume is due to RCRA hazardous waste determinations, this is not verifiable based on review of the information contained in EPA's cost appendix. See Comment 18 for more comments on RCRA hazardous waste determinations.) Per above, the PTW guidance does not support the need for treatment for all the materials falling within EPA's wide definition of PTW for this Site.*

d. EPA is using extremely low dioxin/furan PRGs for PTW determinations that the LWG has previously commented are technically incorrect and not reflective of actual baseline risks (LWG 2014d, 2015a, 2015b). Also, as noted above for PCBs, EPA's dioxin and furan PTW levels are extremely low as compared to other common regulatory programs. For example, EPA's TCDD PTW level is 10 ng/kg in Table 3.2-1, while EPA's soil remedial goal for residential areas is 50 ng/kg.5

e. From a purely engineering perspective, it is not be necessary to conduct ex situ treatment of EPA-identified PTW before disposing of this material in a permitted landfill. The landfill acceptability criteria EPA discusses in Section 3 indicate that most of the PTW (as defined by EPA) would be reliably contained at the landfill without need for prior ex situ treatment (not just PCB and dioxin/furan PTW).

<u>EPA Position:</u>
The comment appears to be about both identification of PTW and the statutory requirement that remedies be cost effective.

<u>Identification of PTW:</u>
The NCP states that EPA expects to use treatment to address the principal threats posed by a site, whenever practicable" and "engineering controls, such as containment, for waste that poses a relatively low long-term threat." [40 CFR Section 300.430(a)(1)(iii).]

As noted in *A Guide to Principal Threat and Low- Level Threat Wastes* (Superfund Publication 9380.06FS, November 1991):

> Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. They include liquids and other highly mobile materials (e.g., solvents) or materials having high concentrations of toxic compound.

Therefore, principal threat wastes are either highly toxic **OR** they are highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur.

Highly toxic principal threat waste at Portland Harbor was identified based on a 10^{-3} risk for an individual contaminant which is three orders of magnitude greater than EPA's point of departure for acceptable risk [see NCP 40 CFR Section 300.430(a)(1)(iii)] and with the Oregon State residual risk ARAR of 10^{-6} for individual contaminants and an order of magnitude greater than EPAs upper risk range for cumulative carcinogenic risks. Contaminants with concentration in the Site determined to be highly toxic include PCBs, cPAHs, DDx, and dioxins/furans (2,3,7,8-TCDD, 2,3,7,8-TCDF, 1,2,3,7,8-PeCDD, 2,3,4,7,8-PeCDF, and 1,2,3,4,6,7,8-HxCDF).

EPA disagrees with the Respondents that current Site risks, based on recent fish tissue samples it conducted, are likely less that 10^{-3}. That statement is speculative and not supported beyond the LWG's own interpretation of the fish tissue data, which is based solely on one fish species (smallmouth bass) and one contaminant (PCBs) and the selected fish species sampled was the third least contaminated species of all fish sampled during the RI. Whereas, the BHHRA evaluated risk from fish consumption based on four fish species.

Highly mobile principal threat waste at Portland Harbor was defined as NAPL that generally cannot be reliably contained **OR** would present a significant risk to human health or the environment should exposure occur. NAPL generally releases contaminants into the groundwater or surface water and cannot be reliably contained and poses significant risk to human health or the environment. EPA evaluated two sources of NAPL, MGP waste offshore of NW Natural and chlorobenzene offshore of Arkema. These NAPL sources release benzo(a)pyrene and napthalene (MGP waste), and DDT (Arkema) to groundwater and pore water. EPA clearly stated in the 2016 FS that the chlorobenzene dissolves the DDT and makes it bioavailable – the BERA concluded dissolved phase DDx in pore water (TZW) had an HQ of 210. Benzo(a)pyrene (a PAH) and DDT have been identified in the BERA as having contaminants of ecological significance and napthalene and chlorobenzene have HQs of 1,100 and 190, respectively. EPA conducted an evaluation of benzo(a)pyrene, napthalene, chlorobenzene, PCBs and DDT to determine if they were reliably contained. DDT (not comingled with chlorobenzene) and PCBs were determined to be reliably containable at all concentrations. Benzo(a)pyrene at concentrations greater than 140,000 µg/kg, and napthalene and chlorobenzene at any concentration was determined to not be reliably containable. Therefore, the MGP waste and the chlorobenzene are both highly mobile principal threat waste. While modeling may potentially be an indicator of potential performance in some situations, it is not deterministic that the waste will actually be contained in the given situation.

"Reliably contained" alone was not used in identifying principal threat waste since that was not a requirement of the NCP nor EPA guidance *A Guide to Principal Threat and Low- Level Threat*

Wastes. Further, there is no requirement that highly toxic source material be reliably contained. However, Highlight 3 in *A Guide to Principal Threat and Low- Level Threat Wastes* provides an example of mobile source material as:

> Mobile source material - surface soil or subsurface soil containing high concentrations of contaminants of concern that are (or potentially are) mobile due to wind entrainment, volatilization (e.g., VOCs), surface runoff, or sub-surface transport.

EPA evaluated whether surface or subsurface sediment containing high concentrations of contaminants of concern are (or potentially are) mobile due to river currents, volatilization, wind/wake wave action or partitioning to pore water or surface water. In other words, any sediments with high concentrations of contaminants that are found in other media (surface water, pore water, biota) that are transported through various environmental mechanisms is a mobile source material. Consequently, the highly toxic principal threat wastes could also be deemed highly mobile source material. However, many of these contaminants (PCBs, DDT not comingled with chlorobenzene, and dioxins/furans) can be reliably contained (as discussed above) and thus were not identified as highly mobile source material.

EPA's evaluation of principal threat waste is consistent with the exposure assumptions at this Site. Highlight 2 in *A Guide to Principal Threat and Low- Level Threat Wastes* identifies contaminated sediment as source material, so the media of which is source material is the contaminated sediment. Further, on p.2 of EPA's *A Guide to Principal Threat and Low- Level Threat Wastes* it states:

> Determinations as to whether a source material is a principal or low level threat waste should be based on the inherent toxicity as well as a consideration of the physica1 state of the material (e.g., liquid), the potential mobility of the wastes in the particular environmental setting, and the lability and degradation products of the material. However, this concept of principal and low level threat waste should not necessarily be equated with the risks posed by site contaminants via various exposure pathways. Although the characterization of some material as principal or low level threats takes into account toxicity (and is thus related to degree of risk posed assuming exposure occurs), characterizing a waste as a principal threat does not mean that the waste poses the primary risk at the site.

As an example of this, EPA's *A Guide to Principal Threat and Low- Level Threat Wastes* on p.2 provides:

> For example, buried drums leaking solvents into ground water would be considered a principal threat waste, yet the primary risk at the site (assuming little or no direct contact threat) could be ingestion of contaminated ground water, which as discussed above is not considered to be a source material, and thus would not be categorized as a principal threat.

A similar scenario was used at Portland Harbor where the contaminated sediment are releasing contamination into surface water and biota is a principal threat waste even though the primary risk at the site (assuming little or no direct contact threat) is consumption of contaminated fish.

EPA would argue that the contamination in the fish itself is not a principal threat waste (similar to groundwater in the example above), but the contamination in the sediment is akin to the leaking drum that is the source material.

Identification of PTW is site-specific based on risk from exposure at the Site. All principal threat waste decisions are site-specific. As stated in EPA's *A Guide to Principal Threat and Low- Level Threat Wastes*:

> Although remedy selection decisions are ultimately site-specific determinations based on an analysis of remedial alternatives using the nine evaluation criteria, these expectations help to streamline and focus the remedial investigation/feasibility study (RI/FS) on appropriate waste management options.

Thus, EPA only used site-specific information to identify principal threat waste and determine waste disposal options (including treatment) at this site.

Identification of principal threat waste and source material is not based on a site-wide average since EPA is not designating the entire Site as containing principal threat waste. Consistent with EPA guidance, principal threat waste is high concentration areas of contamination. Those high concentration areas are identified as samples that exceed the threshold for principal threat waste. For highly toxic contaminants, those concentrations are provided in Table 3.2-1, and comprise 145 acres of the Site (less than 7 percent of the Site). The 2016 FS evaluation complied with the NCP expectation that treatment be used to address the principal threats posed by the Site, wherever practicable (40 CFR §300.430). However, based on the technology assignment process in the 2016 FS, if sediment classified as containing PTW was located in an area designated for capping, then there was an assumption that a reactive cap will be assumed for that area to meet the preference for treatment. The exact presence, location, and treatment requirements (ex-situ or in-situ) of principal threat waste will be determined in remedial design consistent with requirements in the ROD. EPA used the information currently available to base the cost evaluation for treatment of principal threat waste in the 2016 FS.

Furthermore, we strenuously disagree with the LWG's argument that any PCB contaminated sediment under 50 ppm should not be identified as highly toxic PTW because that is TSCA's regulatory threshold for disposal of electrical equipment or other PCB-containing materials. Such an argument inappropriately equates two different statutes, one primarily regulatory (TSCA) and one fully remedial. The LWG's view ignores the statutory mandate of CERCLA to select remedies for releases of or threats of releases of hazardous substances that present unacceptable risk to human health or the environment and the NCP's requirement to address principal threats at a site.

<u>Cost Effectiveness:</u>
The issue of cost effectiveness is tied directly to the CERCLA statutory requirement under Section 121(b) (1) that: "The President shall select a remedial action that is protective of human health and the environment, that is cost effective, and that utilizes permanent solutions and alternative treatment ... to the maximum extent practicable."

EPA did not select a remedy in the 2016 FS and therefore this statutory requirement is not applicable to the 2016 FS and is not subject to the dispute provisions in the AOC.

LWG Dispute Issue 2d:

Remediation waste management components of EPA's alternatives are difficult to understand, appear in many cases to be inappropriate or inconsistent with existing requirements, and seem likely to add significant cost without contributing any additional risk reduction benefit. EPA's June 2016 FS no longer includes the disposal decision tree found in the August 2015 FS. Although that decision tree contained multiple errors and inconsistencies, the absence of any such tool in the June 2016 FS makes it difficult to determine EPA's disposal assumptions for FS purposes (or the Proposed Plan). New EPA text in the June 2016 FS makes a few broad statements that could have major impacts on cost. For example, on Page 3-28, EPA notes that all detectable concentrations of pesticides removed from the site would need to follow Oregon Pesticide Rule procedures as interpreted by EPA. This has implications well beyond any areas highlighted by DDx RALs.49

EPA Position:

Section 3.4.9 of the 2016 FS discusses disposal management requirements and each alternative clearly discusses the disposal assumptions in the detailed evaluation of alternatives in Section 4 of the 2016 FS. Dredged material being disposed at an off-site landfill needs to be characterized and when required will be treated if a state or federal law requires it and/or the receiving facility requires it. If there is RCRA characteristic or listed hazardous waste contained in sediment, necessary treatment will be required. Additionally, dredged sediment containing MGP waste that exceeds TCLP criteria for MGP-related constituents and/or special considerations such as worker safety and equipment decontamination will need to be treated for disposal to be protective. **[AR Doc ID # 1198486]** Although not expected due to existing data, if there are dredged sediment that exceeds 50 ppm PCBs, disposal of such dredged sediment will need to comply with TSCA's disposal requirements. At this time, no other dredged material is known to require treatment for off-site disposal.

Respondents did not provide specifics regarding what exactly about the waste management components was difficult for them to understand or what is inappropriate or inconsistent with existing requirements. EPA used the same methodology in developing disposal costs between the alternatives, the estimates are reasonable enough to compare alternatives. True costs will be determined at the time of disposal based on federal or state requirements and/or the requirements of the disposal facility.

LWG Dispute Issue 1e:

Confined Disposal Facility (CDF) acceptance criteria – As the LWG previously commented, EPA made some of the CDF acceptance criteria and performance standards more conservative (Table 3.4-7) since the T4 CDF 60% design, even though EPA references that design as the source of the criteria and standards. This situation has not changed for the June 2016 FS. No rationale is provided for why the changes make the remedy more protective or effective.

EPA Position:

Performance standards for the CDF are presented in Section 3.4.9.2 and Table 3.4-7 of the 2016 FS. The performance standards presented in Table 3.4-7 were taken directly from the CDF performance standards transmitted by EPA to the Lower Willamette Group (LWG) by letter dated February 18, 2010 and as subsequently presented in Table 5-1 of the Terminal 4 Confined Disposal Facility Design Analysis Report (Prefinal 60% Design Deliverable) **[AR Doc # 100007974]**.

Section 3.4.9.2 of the 2016 FS included additional requirements for material that may be disposed of in an on-site CDF. These acceptance criteria prohibit placement of sediment designated as RCRA or state hazardous waste, sediment designated as “Waste or Media containing Waste that May Warrant Additional Management”, PTW that is highly mobile or cannot be reliably contained, sediment containing free oil or NAPL, or material without suitable geotechnical or geochemical properties. These acceptance criteria are consistent with EPA directed modifications to the CDF as a result of public comment as presented in the Action Memorandum for a Removal Action at the Port of Portland Terminal 4 site with the Portland Harbor Site. **[AR Doc # 1225662]**

1. Only sediments from the Portland Harbor Superfund Site are eligible for placement in the saturated zone of the CDF.
2. No sediments that may be designated as characteristic hazardous waste or contain free-phase oil would be eligible for placement without treatment to control potential for release and migration of these substances.
3. Sediments must be of acceptable geotechnical character (to be defined during design) such that they do not impact the long-term performance of the CDF.

Sediments must undergo appropriate testing including bulk chemistry tests and pancake column leachate test (PCLTs) to document source characteristics acceptable for the CDF. Maximum chemical concentrations measured in representative PCLTs of the sediments must be protective (to be defined during design) of surface water quality criteria.

LWG Dispute Issue 1f:
Cost estimates, volumes, production rates, and construction durations are inaccurate and lack transparency. The LWG previously commented on the August 2015 draft FS that EPA underestimated volumes and construction durations and used impossibly aggressive production rates and unattainable efficiencies given the required BMPs, complex disposal requirements, nearby residential community, and heavily used Willamette River. Due to these factors and other questionable costing approaches, the LWG commented that EPA’s costs were substantially underestimated and consistently minimize the apparent costs of the larger alternatives and dredging, as compared to the smaller alternatives and capping. EPA’s June 2016 FS cost estimates appear to exacerbate these problems, resulting in even lower overall costs for each alternative.

EPA Position:
A significant portion of this dispute issue appears to be centered on differences of professional opinion regarding the technical viability and implementability of remedial activities. The information provided in the cost estimate is based on the best available information regarding the anticipated scope of the remedial alternatives, and thus the issue at dispute is the technical assumptions and not the costs that they reflect. The stated purpose for FS cost estimates in EPA’s *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (p.1-2) is

to compare remedial alternatives during the remedy selection process. The stated accuracy in this guidance for FS cost estimates at the detailed analysis phase is +50 to -30 percent of actual cost. The cost estimates were reviewed by EPA's National Remedy Review Board (NRRB). The NRRB reviewed the FS cost estimates in November 2015 and indicated that the costs presented were generally in the range of costs at other contaminated sediment Superfund Sites. **[AR Doc # 100001536]** The NRRB, while determining that the costs used were reasonable when compared to other contaminated sediment Superfund sites, did recommend further evaluation of specific assumptions and related costs. EPA reviewed comments pertaining to cost estimates and made changes to assumptions for all alternatives and updated the cost estimates, as appropriate, to better reflect the anticipated scope of a future remedy for the Portland Harbor Site as it became further defined between November 2015 and the 2016 FS. For instance, EPA reviewed assumptions pertaining to treatment of contaminated sediment for consistency with early actions and also reviewed unit costs for remedy components such as capping and dredging to reflect consistency with the productivity rates anticipated in EPA's evaluations. Reevaluations of these assumptions, specifically due to more refined development of the alternative's scopes, resulted in lower overall costs in the 2016 FS than as presented to the NRRB in November 2015. EPA's position is that the cost methodology and sources used in the 2016 FS meet the stated accuracy range.

Additionally, the detailed cost backup and individual cost summaries for each alternative presented in Appendix G meet the documentation guidelines presented in Chapter 6 of EPA's *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*.

See EPA's position to LWG's dispute issue 2f regarding dredge volumes.

A detailed construction schedule generally is not produced in an FS because the level of scope definition is too low to make those design-level determinations. However, a cursory evaluation of construction duration was performed for the major construction components (capping and dredging) as indicated in Appendix D.3. It should be noted that schedules indicate a minimum duration and that longer durations only affect present value cost as estimated. The productivity rates presented in a memo to LWG on August 14, 2015, from USACE was used to calculate construction durations **(AR Doc # 100011624 and 100033480)**.

The complexity of the disposal requirements is a factor of the material characteristics and is governed by regulatory considerations, which are presented Section 3.4.9.1 of the 2016 FS. EPA's position is that the complexity of the disposal requirements is appropriate for the expected material generated during remedial activities. The fact that LWG claims that the disposal requirements are too complex does not support the LWGs opinion that the cost estimates are substantially underestimated.

The cost estimate takes into account site specific difficulties expected with implementation. EPA developed project-specific unit costs using the Micro Computer Aided Cost Engineering System (MCACES) Second Generation (MII) software version 4.2, build 3. EPA's position is that the productivity rates along with the crew development used for development of site-specific unit costs are reasonable for an FS level evaluation and meet the stated accuracy range of EPA's *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*.

Missing cost elements:

EPA's cost estimate does not include the 3 to 5 year anticipated "initial conditions" assessment, subsequent pre-remedial design investigations, or additional riverbank sampling and remediation contemplated in the FS and Proposed Plan to be identified in conjunction with this post-ROD sampling. At the Head of the Hylebos project, which was primarily a PCB remediation involving roughly 44 acres, pre-remedial engineering investigation costs amounted to roughly 16% of remedy implementation costs.

EPA Position:

The remedial design percentage included as a percentage of the capital costs per EPA's *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* includes activities such as pre-design investigation and initial conditions assessment. As described in Section 5.5 of that guidance, engineering judgment may be used to adjust rule-of-thumb percentages presented in Exhibit 5-8 for project management, remedial design, and construction management as well as the recommended range presented for technical support. As described in the 2016 FS, Appendix G, Attachment A, the percentages of professional and technical services costs are generally higher for projects of smaller scope and lower for projects of larger scope. The scope of the cleanup activities within the Portland Harbor Superfund site (thousands of acres) is much larger than the scope of the Head of the Hylebos project (tens of acres), and therefore it is expected that the percentage for remedial design costs used as a function of capital costs will be higher for the Head of Hylebos project and lower for the Portland Harbor Superfund Site.

The remedial design costs presented in the 2016 FS for each alternative were estimated to be comparable to remedial design costs estimated for alternatives evaluated in the Lower Duwamish Final FS, when reviewed on an annualized basis. The specific scope and costs for the "initial conditions assessment, subsequent pre-remedial design investigations, or additional riverbank sampling and remediation" will be identified during remedial design based on factors such as funding, phasing, and scheduling of work. Unknowns or unforeseen conditions for these activities and related costs not entirely captured in the remedial design percentage can be considered to be captured in the scope contingency applied to each alternative.

EPA does not appear to include any Oregon Department of State Lands (DSL) costs for access, leases and easements required for investigation, dredging, capping and monitoring activities. In documents the LWG obtained through its FOIA request to EPA, EPA's FS contractor acknowledged that these costs – which he characterized as "incredibly large" – were not included in the FS evaluations.50

50 See, DEQ/EPA Cost Notes (January 28, 2016) (R10-100007897), p. 11 (Attachment 4).

EPA Position:

Per EPA's *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, fees not otherwise covered by a direct line item are covered by a percentage of the capital and periodic costs in the professional/technical oversight named "project management." The EPA's *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* defines "direct costs" of cleanup as "the equipment, labor, and material costs necessary to construct the remedial action (including contractor markups, such as overhead and profit)."

EPA acknowledges that the Board of State Lands through the Department of State Lands promulgated rules for granting and renewal of access authorizations, leases, and easements issued to facilitate remediation conducted pursuant to an order issued by ODEQ or EPA and habitat restoration activities in, on, under or over state-owned submerged and submersible land. In general, section 104 of CERCLA, 42 U.S.C. Section 9604 provides the President with broad authority to take response actions to protect human health and the environment where there is a release or potential threat of a release into the environment of hazardous substances (or pollutants and contaminants presenting an imminent and substantial endangerment to public health and welfare). In addition, subsection (e)(3) of Section 104 specifically provides the President authority to access **"[a]**ny vessel, facility, establishment, or other place or property where entry is needed to . . . effectuate a response action under" . . . CERCLA. Furthermore, Section 121(e)(1) of CERCLA provides **that: "[n]**o State, or local permit shall be required for the portion of any removal or remedial action conducted entirely onsite, where such remedial action is selected and carried out in compliance with . . ." CERCLA. The statute provides clear authority for EPA to take or require cleanup actions be taken, and explicitly states that no permit or license is required to perform a response action on-site. We also note that as a general matter, the United States is not required to pay state or local fees, unless Congress explicitly so requires. EPA anticipates that PRPs, including DSL, will perform the Portland Harbor cleanup and reasonable terms of access to private and state-owned property to implement the remedy likely will be the subject of future negotiation between the PRPs, landowners, and DSL; however, what those terms will be and what if any compensation is agreed to is too speculative at this time.

EPA's cost estimate does not include agency oversight and participation costs. These costs have represented more than 27% of RI/FS costs at Portland Harbor.

EPA Position:
Oversight costs are included as a percentage of the capital and periodic costs in the professional/technical oversight named "construction management" and "project management". See section 5.5 of EPA's *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study.*

EPA's cost estimate does not include the required 12-inch daily cover layer, which appears to be a new requirement to reduce dredging releases.

EPA Position:
The cost estimate in the 2016 FS, Appendix G, includes the 12-inch dredge residual layer in the volume of sand. The 2016 FS does not prescribe this as a daily cover.

EPA does not factor the need to acquire and develop transload facilities into the schedule.

EPA Position:
The 2016 FS does not provide construction schedules for alternatives, which is more appropriate during remedial design. However, cursory evaluations of construction durations were included for purposes of implementability and cost evaluations within Appendix D.3. The feasibility study assumes that the development of transload facility will be included in the initial year of preparatory activities. The assumption of preparatory activities occurring in the initial year is

stated in the 2016 FS, Appendix D, Footnote K of Table D3-1 (Construction Duration Assumptions). The initial year of preparatory activities would include pre-design investigations and start-up activities prior to beginning construction (in-water work). It is assumed that start-up activities would include development of transload facility, mobilization, setting up of staging area, preparation of the CDF (if applicable), etc. Expansion of the transload facility or additional transload facilities (if needed) was assumed to be developed concurrently during construction (in-water work) for FS purposes. Start-up activities will be addressed at the appropriate phase of the work, which is in the remedial design workplan.

Underestimated cost elements:

EPA continues to assume unattainable production rates and efficiencies assuming construction 24 hours per day for the basis of the project schedule and cost estimates. Stepping time is completely ignored. Furthermore, the need to operate in an active navigational channel will mandate the need to move the dredging equipment during each ship movement. According to the Columbia River Pilots Association there are 2 to 5 of such movements through this site daily. Each will represent a significant disruption and will result is significant loss of dredging and remedial project efficiency. The FS assumes that numerous requirements for innovative and complex dredge Best Management Practices (BMPs), precision dredging techniques, use of sheet pile barriers in some areas, and a transload and water treatment system (which will act as a bottleneck) will be performed simultaneously without incident or equipment breakdown, and with no additional time on costs.

We note that the Feasibility Study states that a fixed arm articulated bucket is the preferred dredging option where feasible and that a cable bucket will be used in water depths greater than 40 feet. This would correspond to the fixed arm bucket being used for roughly 80% of the dredge volume and cable bucket for 20%. However, the FS inconsistently assumes in the cost estimate and project schedule that the fixed arm bucket is used for 5% of the dredge volume. The cable bucket has a much higher production rate and lower unit cost than the fixed arm bucket. Correcting this assumption would increase alternative durations by 5 to 15 years, depending on 24- or 12-hour work days, respectively.

EPA continues to use aggressive dredging production rates. Sections 2.4.3 and 4.2.2.2 present a number of BMPs and controls to minimize impacts. These BMPs will slow dredging production and increase costs. The LWG's past production rates accounted for these anticipated BMPs which are likely needed to meet 404 water quality certification requirements but EPA's current rates do not.51 Some of these described BMPs and controls include:

- *Sheet piling in select areas*
- *Slowing the dredge cycle time to reduce bucket impacts at the bottom*
- *Rinsing the bucket to clean off excess sediment between loads*
- *Briefly stopping the bucket at the waterline to allow excess water to drain before raising bucket to barge*
- *Having precision cuts of only 50% bucket fills on last passes*
- *Pumping excess water from barges during dredging*
- *Placing a residuals cover daily*
- *Modifying the work schedule*
- *Performing work during low river flows*

• *Fish capture and removal inside work isolation areas*

EPA Position:
A memo was submitted to LWG on August 14, 2015 clarifying the development of the production rates based on an earlier review and recommendation by the Army Corps of Engineers (27-May-2013). **[AR Doc # 100011624]** The assumptions and calculations transmitted in the memo were included in Appendix D, Table D3-1 of the 2016 FS. In contrast to assertions made in the comment, stepping time, allowances for work disruption, and other impediments to dredging operations are accommodated in productivity rate estimates. USACE's 2008 *Technical Guidelines on Environmental Dredging* recommends the use of an Effective working time factor (p. 131): "Effective working time is the time during the dredging operations when actual production is taking place, such as material moving through the pipeline or being placed into a sediment barge. This is also referred to as "operating time." The Effective Work Time factor accommodates "when the dredge is operational but no production is taking place, such as time spent making changes to pipelines, cleaning debris from the suction head, changing sediment barges, moving the dredge, standing by for navigation traffic, making minor operating repairs, and refueling. This is also referred to as "allowable downtime." USACE's 2008 *Technical Guidelines on Environmental Dredging* (p. 93) states that the effective working time is "typically 55 to 70 percent for environmental dredging projects." The estimate used in the 2016 FS (62.5 percent) was the midpoint of that range. In this regard, dredge "operating time" is estimated to occur 15 of 24 hours, six days per week. The effective working time factor was explicitly used to the accommodate issues identified by the commenters as well as other unforeseen circumstances. As stated in the 2013 memo from Dr. Paul Schroeder, USACE ERDC **[AR Doc ID # 500001131]**, "A target production rate of 6000 cy/day, 6 days per week should be achievable even with the assumed efficiency impacts of resuspension control and residuals control and management if water quality, processing and disposal requirement can be met."

Regarding the estimate use of fixed arm vs. cable arm dredging, the 2016 FS, Appendix D, Table D3-1 states "Daily dredge production rates were developed assuming a 55/45 percent mix of cable arm versus articulated bucket dredges, based on the approximate areal percentages of navigation channel and maintenance dredge areas in the alternatives." It's acknowledged that the text in the main body of the feasibility study that is referenced by the commenters does not clearly state this basis (p. 3-22 of the 2016 FS states: "Cable-operated dredges are assumed for those Site conditions where fixed-arm dredges are not viable [such as water depths exceeding 40 feet] and will have no water depth limitations at the Site").

Overall, this and other comments on dredge production imply that overly high production rates falsely equate to shorter construction durations. Even if these FS-level production rate estimates are high, other assumptions lessen the production rates. For example, the in-water construction duration is based on the assumption that "Cap and EMNR construction is assumed to occur in sequence (not in parallel) with dredging for estimating total construction" (2016 FS, Appendix D, Table D3-1). This means that all dredging would occur, then all capping would occur. This assumption is fine for its purpose (estimating a construction duration), but in practice, sequencing would not occur by technology type. Remedial action would be sequenced by area, generally moving from upstream to downstream, capping/dredging contaminated sediment, before moving on to the next area. It would not be reasonable to dredge a portion of an SDU and then return to that SDU two years later to begin capping the remainder of the contaminated sediment. As a result, estimated dredge volumes would be removed over the in-water construction duration, resulting in lesser production rates (e.g., Alternative I, has a 2.27 year estimate for dredging duration; 3.93 years of in-water construction, equating to a 42 percent lower annual production rate over the in-water duration). As a final point, because all alternatives have dredging to some degree, changes to the dredge productivity rates would have similar effects across all alternatives, and not significantly influence remedy selection.

EPA also has aggressive dredging rates for riverbank excavations. It is assuming dredging will be completed from the water with a 6.5 cubic yard (cy) bucket loading a telebelt that will transfer material to a haul barge. It is using an aggressive cycle time of 50 seconds for this work yet still implies use of the same BMPs as described above for sediment work.

EPA Position:

The 50 second cycle time quoted in the comment represents the "ideal cycle time" for riverbank excavation with barge mounted excavator. This does not take into account the 90 percent work efficiency factor and the 0.9 operator ability correction factor, which decreases the productivity. The information quotes in the comment from Appendix G of the 2016 FS was presented specifically for purposes of developing and checking the reasonableness of the presented unit costs (from the perspective of number of crews).

Having said that, the concern from the LWG about reduction of productivity due to use of BMPs is going to be location-dependent based on the type of contamination within the river adjacent to the riverbank and the sediment control BMPs used. Depending on the location-specific conditions, shoreline-based excavation of river banks may be desirable instead of water-based excavation to avoid the types of impediments suggested. Although for cost purposes riverbank excavation presented in Appendix G of the 2016 FS was developed assuming barge mounted excavator, the text of the 2016 FS presents the assumption that land-based excavators are assumed to be used for removal of contaminated river bank materials or near-shore sediment in locations above water levels. The actual approach used (land or water-based excavation) and related scope and costs for riverbank excavation are location-dependent and will be refined during remedial design. The assumption of water-based excavation for riverbanks does not impact the overall accuracy of the 2016 FS cost estimates.

EPA's water treatment plant consists of holding tanks and carbon treatment with no additional costs. EPA indicates that the water will be discharged back to the river. Based on past experience in Portland Harbor, this approach is unlikely to be acceptable. T4 dredging required water discharge to the City's POTW. EPA also assumed that water treatment will only be required during the days of dredging. All precipitation will need to be captured and treated, so the system will be required as long as there is dredged material on site.

EPA Position:

The water treatment costs presented in Appendix G of the 2016 FS, not only includes the costs of the components of water treatment (e.g. holding tanks, bag filters, and carbon adsorption on a skid mounted type system), but also includes crew costs for collecting water from dredging operations for treatment. For purposes of estimating costs, it is assumed that all necessary pretreatment (including dewatering) and handling of dredge materials will occur on the barge prior to arrival at a transload facility. There is no assumed stockpiling of material onsite nor at the transload facility, but that any water discharged from a stockpile area would be captured and treated. The cost estimates assume treatment of collected water on barges and discharge to the Willamette River after treatment.

The text of the 2016 FS indicates that wastewater will likely either require treatment prior to discharge to the lower Willamette River or disposal at a publicly owned treatment works (POTW) facility. While the 2016 FS necessarily assumes a representative set of water treatment process options for the general screening and alternative development procedures, this does not imply that other process options cannot be considered during remedial design. Use of a multi-stage filtration and granular activated carbon adsorption approach to water treatment is assumed as a holistic approach for all dredge material in the cost estimate. However, EPA acknowledges that an expanded treatment system may be required for some material, particularly PTW, on a location-specific basis. Unknowns or unforeseen conditions for these activities and related costs not entirely captured in the costs for water treatment can be considered to be captured in the scope contingency applied to each alternative. The scope and costs for wastewater treatment will be refined during remedial design on a location-specific basis.

Appendix F indicates that Subtitle C material will be hauled to Boardman and then hauled by truck to ChemWaste, similar to what was done for the Gasco Early Action. However, the cost estimate only has 1 day of haul time to Boardman and 18 hours return. The cost estimate assumes that the material would be stockpiled on site at the Boardman transload facility and then loaded into trucks. The Boardman site, used previously for the Gasco Early Action, has only 4 to 9 acres of available space, with the high end of the range assuming that the current operations are terminated to allow for the transloading. This will not be sufficient for the anticipated Subtitle C material EPA plans to remove. For Gasco, the material was loaded directly from the barge to the trucks. The Gasco Early Action processed only approximately 15,000 cy of material, while Portland Harbor will have an orders-of-magnitude-more volume, which will overwhelm the Boardman facility. EPA received a quote from ChemWaste to truck the material from Portland Harbor to their facility as an alternative. However, this would entail 10,555 truck trips of Subtitle C material through Portland neighborhoods.

EPA Position:
The 2016 FS looks at modes of transport and associated transload of wastes from a macro perspective, but the primary assumption in the 2016 FS was to use barges for the purposes of implementability and cost evaluation. The 2016 FS also indicated that multiple modes of transport could be used and could be evaluated during remedial design phase of the project.

EPA talked with the representative facilities including ChemWaste, Port of Morrow (Boardman site) and the barging company (Tidewater Transportation & Terminals) and they did not indicate any significant concerns about logistics of transload of NRC/NAPL PTW waste volumes for transport and disposal at ChemWaste. It should be noted that Tidewater Transportation & Terminals was the barging company used for Gasco Early Action. Also, through discussions with the representative facilities, the cycle time in terms of barging and trucking reflects their cycle time input for a round trip. Based on these discussions and inputs following cycle time for barging was assumed in the FS cost estimates: 1 day of barge time to Port of Morrow (Boardman site) and 18 hours of barge time for return.

The 2016 FS cost estimate does not assume that the barged material would be stockpiled at the Port of Morrow (Boardman site) transload facility. Instead the 2016 FS cost estimate assumes direct loading in two steps; using a crane to offload from barge and a front-end loader to load the trucks. In addition, an offsite transload facility development cost was included to account for additional flexibility in transload. In terms of flexibility, as indicated in Appendix F of the 2016 FS, multiple modes of transport besides barging (rail or truck) could be used to transport waste to ChemWaste from transload locations as determined during remedial design. It should be noted that ChemWaste had indicated for budgetary purposes for the feasibility study that the cost of transport wouldn't differ significantly between the various modes of transport once transload was taken into account.

The ChemWaste landfill is assumed to only be used for disposal of NRC/ NAPL PTW. As compared to Gasco Early Action (~15,000 CY), the Portland Harbor Superfund Site remedial action will generate a large volume of waste material for disposal at ChemWaste (~285,000 CY); however this volume is assumed to be generated over a longer construction duration of 5 seasons as assumed for Alternative I. Based on these assumptions it is estimated that approximately 2,400 CY per week (which is approximately 1 to 2 barges per week) would be handled at the transload facility for disposal at ChemWaste. As mentioned above, the barging company, the transload facility, and disposal facility did not indicate any significant concerns about logistics of handling the required volume for transportation, transload and disposal.

The cost estimate appears to assume the Subtitle D material is barged to Bingen and then hauled by truck to the Roosevelt Landfill. There is no analysis of whether the Bingen offloading facility could accommodate 6,200 cy per day of dredged material for processing. EPA is also assuming that diatomaceous earth is added into the sediments to absorb the free water, but they do not account for the $9M in added tonnage for disposal.

EPA Position:

The assumption in the 2016 FS for contaminated sediment disposed of at a Subtitle D facility is that it is barged to Bingen and hauled by truck to Roosevelt Landfill. EPA did have a discussion with Roosevelt Landfill facility about their ability to transload material from barge and they indicated the ability to accommodate the quantity that the project may develop, specifically including their ability to handle 6,200 cy/day of dredged material. They also indicated that there are sufficient options available since Roosevelt Landfill facility has agreements with a number of transload facility locations along the Columbia River including potential plans to build a new transload facility irrespective of this project (see 2016 FS Appendix G, Cost Estimate Backup Project- Specific Vendor Quotes).

LWG is incorrect that diatomaceous earth was not accounted for in the disposal costs. As described in the 2016 FS, Appendix D [D2.4 Treatment and Disposal Quantities, D2.16 Truck, Rail, Barge Loads for Disposal Volumes (DMM Scenario 1 - Confined Disposal Facility and Off-Site Disposal), and D2.17 Truck, Rail, Barge Loads for Disposal Volumes (DMM Scenario 2 - Off-Site Disposal)], the volume or tonnage of diatomaceous earth required for pre-treatment was considered and included in overall volumes and tonnages for transportation and disposal. These quantities were presented in the tables referenced in the 2016 FS, Appendix D2.4, D2.16, and D2.17, and were subsequently used in the cost worksheets for the alternative cost estimates within Appendix G. Also, the 2016 FS, Table D2.d, shows the calculations that illustrates the inclusion of diatomaceous earth for all dredged sediment (except those destined for CDF disposal under DMM Scenario 1).

EPA does not provide any details on project schedule related to integration of dredging, daily covers, and caps. Capping materials alone include more than 800,000 cy. Two capping plants working 12 hours per day would be needed to place roughly 200,000 cy per season per LWG estimates; EPA's estimated rates are 600,000 cy per season from two plants with one working 24 hours per day and one working 12 hours per day.

EPA Position:
LWG is incorrect that EPA does not provide any details regarding schedule related to integration of dredging and capping. The feasibility study does not provide construction schedules for alternatives, which is more appropriate during remedial design. However, cursory evaluations of construction durations were included for purposes of implementability and cost evaluations within Appendix D.3 of the 2016 FS. These evaluations were primarily based on the major construction components driving overall durations (specifically capping, dredging, and in situ treatment) using the USACE-determined productivities as indicated in Appendix D.3 of the 2016 FS. This table explicitly documents the methodology used to arrive at the construction durations with respect to capping and dredging.

LWG is also incorrect regarding EPA's assumptions of the number of capping plants and their productivities. EPA assumed three plants, not two, operating 6 days per week with one day of maintenance per week. The estimated productivity of each of these plants is 1,500 CY per day (4,500 cy per day total) but that placement rate was reduced in the construction duration estimates to 3,900 CY per day for all three plants to account for a weekly average. These assumptions are stated in the 2016 FS, Appendix D, Assumption No. 4 in Table D3-1 (Construction Duration Assumptions).

EPA continues to use a very simplistic approach to estimating dredge volumes, which has a large potential to substantially underestimate the dredge volumes eventually determined in remedial design.

EPA Position:
EPA disagrees that a simplistic approach was used to estimate dredge volumes in the 2016 FS. EPA developed dredge volumes using "neat" line volumes based on interpolated area and depth data. To take into account side slope stability (dredge prism), neat volumes were multiplied by a factor of 1.5 to estimate the Low Volume with Overdredge, and by a factor of 2.0 to estimate the High Volume with Overdredge. Total volumes for each alternative were calculated as the average of the estimated low and high overdredge volumes. This is consistent with information presented in the Corps Technical Guidelines for Environmental Dredging of Contaminated Sediments (Palermo et. al., September 2008) – Section 3.4.3:

> "For FS level considerations, an adjustment factor of 50 percent (i.e., an estimated dredge prism volume equal to 1.5 times the neat line prism volume) is appropriate for typical site conditions."

Guidance states that the ratio of dredge prism (including allowable overdraft) to the neat line prism (which is what EPA assumed in the 2016 FS) can be as high as 3 based on work at the U.S. Navy Homeporting project in Everett, Washington. However, it seems that the estimate of dredge prism to neat line ratio of 1.5 – 2.0 is reasonable for Portland Harbor and consistent with the guidance for an FS level evaluation. During remedial design, dredge prisms will be developed that minimize the amount of material that will need to be removed through dredging.

EPA uses the same 7% discount rate as used in the EPA 2015 draft FS, which heavily discounts the larger alternatives (i.e., Alternative E is discounted a total of 41% and Alternative G is discounted by 77%). This discount rate is indicated on the first page of EPA's 2000 cost estimate guidance for FSs. However, the second complete paragraph on Page 4-5 of that guidance indicates that a different discount rate can be used as long as it is justified consistent with OMB Circular A-94. Accordingly, the LWG's 2012 draft FS used a discount rate of 2.3%, consistent with guidance as explained in that document. The equivalent treasury rate for 2016 is 1.5%, which is a much more appropriate discount rate at a site where the PRPs include the United States, the State of Oregon, municipalities, public utilities, and many parties whose principal or only source of funding for cleanup are insurance funds outside their investment control. It is also the rate that EPA would presumably use in calculating required financial assurance.52

52 2016 Discount Rates for OMB Circular No. A-94, M-16-05 (Office of Management and Budget, February 12, 2016)

<u>EPA Position:</u>
As discussed in EPA's *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (EPA 540-R-00-002), the real discount (interest) rate used for present value analysis in the FS depends on whether the site is classified as a Federal facility site. Federal facility sites are former or current installations operated or controlled by a Federal government agency and identified by EPA's Federal Facilities Restoration and Reuse Office (FFRRO). The Portland Harbor Superfund Site is not a Federal facility identified within FFRRO's site inventory. In addition, the guidance specifically mentions that although a Federal-lead site cleaned up by EPA using the Superfund trust fund (Fund-lead sites) may be an analogous situation to a Federal facility site being cleaned up using Superfund authority, there is always a chance that a potentially responsible party (PRP) could remediate the site. Thus, per guidance a real discount rate of 7 percent should be used in calculating present value costs for all non-Federal facility sites such as the Portland Harbor Superfund Site. This expectation is documented in the last paragraph of Page 4-5 of the guidance.

EPA's *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* in the second paragraph on page 4-5 also specifically states that any changes to EPA's policy to use a 7 percent discount will be reflected in an update to OSWER Directive 9355.3-20. EPA has not updated that directive, and thus use of a 7 percent real discount rate is still the expectation per that directive. Furthermore, while the statement that a differing discount rate can be considered based on a change to the discount rate within OMB Circular A-94 is correct, OMB has not changed from a 7 percent real discount rate (see Paragraph 8(b)(1) of OMB Circular A-94). Updates to discount rate in Appendix C of OMB Circular A-94 are not considered changes to the policy (see second paragraph on Page 4-5 of EPA 540-R-00-002 and related Footnote 3).

LWG also asserts that a differing discount rate should be used to be consistent with financial assurance practices used for these types of sites that use funding from PRPs. As indicated on Page 2-3 of EPA's *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study*:

> As a project moves from the planning stage into the design and implementation stage, the level of project definition increases, thus allowing for a more accurate cost estimate. An "early" estimate of the project's life cycle costs is made during the FS to make a remedy selection decision.
>
> At the FS stage, the design for the remedial action project is still conceptual, not detailed, and the cost estimate is considered to be "order-of-magnitude." The cost engineer must make assumptions about the detailed design in order to prepare the cost estimate. As a project progresses, the design becomes more complete and the cost estimate becomes more "definitive," thus increasing the accuracy of the cost estimate. This process is depicted in Exhibit 2-3 for remedial action projects in the Superfund program.

Further, EPA's *Guidance on Financial Assurance in Superfund Settlement Agreements and Unilateral Administrative Orders* (p. 5) states:

> 2. Considerations for applying a discount rate for FA
>
> A discount rate is the interest rate used in calculating the present value of expected future costs.[16] As noted in existing EPA guidance for documenting cost estimates during the FS, the Agency generally uses a 7% real discount rate to compare alternatives during the remedy selection process.[17] The goal of that guidance was to improve consistency, completeness, and accuracy of cost estimates developed specifically during the feasibility study phase of the Superfund remedy selection process, but not to offer guidance on determining an FA amount.
>
> FA requirements are generally designed to ensure that sufficient funds are available for the government or another party to complete cleanup work if a PRP does not perform the required work. The Agency believes that FA based on a 7% discount rate could be insufficient to perform the work because funds called in from FA mechanisms are typically deposited into "special accounts"[18] or standby trusts, which are unlikely to grow at this annualized real rate.
>
> [16] If a discount rate is applied to a cost estimate to establish an FA amount, it would take into account the time value of money—the general idea that a dollar today is worth more than a dollar tomorrow—by assuming that the initial FA amount would appreciate over time at a projected growth rate. The higher the discount rate that is applied, the less FA would initially be required, and the more it would need to appreciate to meet the anticipated funding needs at the site.
>
> [17] See EPA Office of Solid Waste and Emergency Response, OSWER 9355.0-75, A Guide to Developing and Documenting Cost Estimates During the Feasibility Study (July 2000), p. 4-4, available at http://www.epa.gov/superfund/policy/remedy/pdfs/finaldoc.pdf

(stating that the “specified rate of 7% represents a ‘real’ discount rate in that it approximates the marginal pretax rate of return on an average investment in the private sector in recent years and has been adjusted to eliminate the effect of expected inflation”).

[18] Special accounts are site-specific, interest-bearing accounts within the Superfund. For documents concerning special accounts, view the Special Accounts category in the Superfund enforcement policy and guidance database, available at http://cfpub.epa.gov/compliance/resources/policies/cleanup/superfund/index.cfm?action=3&sub_id=1235.

Thus, the development of cost estimates in the 2016 FS was consistent with EPA’s cost and financial assurance guidance and used the appropriate discount rate where the primary purpose is for comparing remedial alternatives during the remedy selection process.

It should be noted that while EPA used a 7 percent real discount rate for presentation of the alternative costs, a sensitivity analysis was performed for varying discount rates and presented in Appendix N of the 2016 FS. This is consistent with the recommendation in the third paragraph on Page 4-5 of EPA’s *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study*.

EPA used a low mobilization/demobilization factor of 1.6%, while the 2012 draft FS used a 15% factor based on project experience at similar sites. EPA is basing its 1.6% percentage on the cost estimate used for the Lower Duwamish River FS—not real construction data.

EPA Position:
LWG is correct that construction data were not specifically used for determination of the mobilization/demobilization factor. However, EPA’s *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (EPA 540-R-00-002), actual construction data is not required to be solely used. As indicated on page 5-6 of that guidance, “experience with similar projects, including both estimates and actual costs (bold emphasis added) can also be used as a source of cost data.”

In addition, the determination of the percentage of the capital and periodic costs for mobilization and demobilization was based not just on review of Lower Duwamish River FS, but also the Passaic River FS, projects of similar scope and the equipment proposed for Portland Harbor FS. The types of dredge can cap placement equipment proposed in the Portland Harbor 2016 FS (the primary pieces of equipment requiring mobilization/demobilization from beyond metro Portland) are fairly conventional in that they are barge mounted excavation and placement equipment and not unique types of dredge equipment such as suction dredges. In addition, the number of dredge plants and capping plants and attending scow barges and tugboats are relatively small given the duration of the project. Thus they should readily available in the Pacific Northwest given the multitude of shoreline projects along the Willamette and Columbia Rivers. EPA has thus assumed mobilization and demobilization are representative of expected regional mobilization and demobilization costs.

The use of a percentage of capital costs for mobilization and demobilization of equipment is reasonable for the FS level of scope detail and assumptions. Real construction data will be evaluated and presented during remedial design as necessary.

It should be noted that unlike alternatives for some Superfund projects, the primary differences between the alternatives for the Portland harbor Superfund Site is the size of the footprint of removal and containment based on the area of the SMAs defined for each alternative. Therefore, the cost differences between alternatives is reflective of the differing quantities calculated in the technology assignment modeling. Because the differences in capital and periodic costs are primarily based on quantity differences, the use of lower percentages for mobilization/demobilization costs do not impact the comparative aspects of the costs estimates between alternatives.

EPA used a contingency factor of only 20%, while the LWG's 2012 draft FS used 40%. EPA guidance indicates that the overall contingency for an FS should be in the 20 to 45% range. Thus, EPA is using the lowest possible contingency factor allowed by guidance. EPA cites guidance indicating that larger projects with high costs may have lower overall contingency factors. This may be true for some types of projects, but given the complexity of this Site and the large number of issues that will be refined in design, using the lowest possible contingency factor appears very optimistic and greatly decreases the estimated costs of the alternatives, particularly the largest alternatives.

EPA Position:

The stated accuracy in EPA's *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* for FS cost estimates at the detailed analysis phase is +50 to -30 percent of actual cost. EPA's position is that the cost methodology and sources used in the FS meet the stated accuracy range. The information provided in the cost estimate is based on the best available information regarding the anticipated scope of the remedial alternatives.

As described in Section 5.4 of EPA's *A Guide to Developing and Documenting Cost Estimates During the Feasibility Sutdy*, engineering judgment may be used to adjust rule-of-thumb percentages presented in Exhibit 5-6 for scope contingency with a lower contingency indicating that project scope will undergo minimal change during design. Due to the detailed level of conceptual design performed as part of the technology assignment modeling in the 2016 FS, the contingency percentages were modified to the low end of the recommended range presented in the guidance, to better reflect the detailed evaluation and concepts developed for the following items:

> Per EPA's *A Guide to Developing and Documenting Cost Estimates During the Feasibility Sutdy*, contributing factors to scope contingency include the following:
>
> - Limited experience with certain technologies
> - Inaccuracies in defining quantities or characteristics
> - Potential requirements due to regulatory or policy changes

Scope contingency would be expected to be higher for newer or emerging remedial technologies than for more well-documented systems. Each alternative was developed using similar technologies and major work activities. Conventional and proven technologies were used in the development of the alternatives with only few exceptions (in situ treatment areas) representing a relatively small percentage of the scope.

The primary differences between the alternatives is the size of the footprint of removal and containment based on the area of the SMAs defined for each alternative. Therefore, the cost differences between alternatives is reflective of the differing quantities calculated in the technology assignment modeling. The development of the RALs for each alternative established a boundary for the horizontal limits of dredging/capping based on available boring data. There is a vertical limit for dredge volumes in the shallow and intermediate areas based on the technology assignments, and this will limit the risk for potential growth of volume estimates in those areas.

EPA assumes all NAPL PTW will be dredged in the Navigation and FMD areas. However, the Willamette River currently has an authorized channel depth of -40 feet Columbia River Datum (CRD), and contamination at depths greater than the authorized depth of the navigation channel may be capped as long as the cap integrity is not impaired by future maintenance dredging.

Federal and State regulations were carefully evaluated and taken into consideration in the assignment of technologies (mitigation and floodrise) for development of all alternatives.

EPA ultimately selected a scope contingency (10 percent) within the parameters suggested by the guidance, after taking this information into account. For instance, Exhibit 5-6 of EPA's *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* indicates a recommended scope contingency range of 5 to 10 percent for surface grading/diking, 5 to 15 percent for bulk liquid processing, 5 to 15 percent for on-site and off-site disposal, 10 to 20 percent for sludge stabilization. All of these are activities that are part of the scope of the Portland Harbor alternatives and are at within the range of the scope contingency selected by EPA. While vertical barriers (10 to 30 percent) and soil excavation (15 to 55 percent) are at or higher than the selected value, the refined development of quantities and scope in the 2016 FS minimize the likelihood that significant unknowns and uncertainties remain that would result in large underestimation of costs requiring scope contingency.

Bid contingency accounts for changes that occur after the construction contract is awarded. Examples include:

- technological, geotechnical, and other unknowns applicable to the construction phase
- changes due to adverse weather
- material or supply shortages

Conventional and proven technologies were used in the development of the alternatives with only few exceptions. The site specific unit costs developed for the Portland Harbor Superfund Site and presented in Appendix G of the 2016 FS were generally in the range of costs at other contaminated sites in the Pacific Northwest. This reduces the risk of technical constraints during contractor bidding. Inputs and assumptions used in the development of the construction duration calculations included an in-water work window which is appropriate for the region.

A vast majority of the materials and supplies identified as necessary for remedial action are conventional and readily available (sand, DE, quick lime). EPA assumes commercial source of capping materials, and assumes that more than one source may be required. EPA confirmed that commercial suppliers could supply the required volumes.

EPA ultimately selected a bid contingency (10 percent) within the parameters suggested by the guidance, after taking this information into account. Page 5-11 of EPA's *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* indicates a recommended scope contingency range of 10 to 20 percent. This is within the range of the bid contingency selected by EPA.

Unlike alternatives for some Superfund projects, the primary differences between the alternatives for the Portland harbor Superfund Site is the size of the footprint of removal and containment based on the area of the SMAs defined for each alternative. Therefore, the cost differences between alternatives is reflective of the differing quantities calculated in the technology assignment modeling. Because the differences in capital and periodic costs are primarily based on quantity differences, the use of lower percentages for contingency do not impact the comparative aspects of the costs estimates between alternatives.

EPA used lower percentages for project management (2%), remedial design (2%), and construction management (3%) than EPA guidance (5%, 6%, and 6%, respectively). These factors are also lower than the 2012 draft FS, which used 15% for remedial design and a monthly rate for project management and construction management. Remedial engineering design costs at the Head of the Hylebos were roughly 15% of actual project costs.

<u>EPA Position:</u>
As described in Section 5.5 of EPA's *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, engineering judgment may be used to adjust rule-of-thumb percentages presented in Exhibit 5-8 for project management, remedial design, and construction management as well as the recommended range presented for technical support. As described in the 2016 FS, Appendix G, Attachment A, the percentages of professional and technical services costs will be higher for projects of smaller scope and lower for projects of larger scope. Due to the high overall costs for major work activities, the professional/technical percentages were modified to lower than the recommended range presented in the guidance, to better reflect realistic costs for professional/technical services costs for these items.

It should be noted that unlike alternatives for some Superfund projects, the primary differences between the alternatives for the Portland harbor Superfund Site is the size of the footprint of removal and containment based on the area of the SMAs defined for each alternative. Therefore, the cost differences between alternatives is reflective of the differing quantities calculated in the technology assignment modeling. Because the differences in capital and periodic costs are primarily based on quantity differences, the use of lower percentages for these professional/technical services costs do not impact the comparative aspects of the costs estimates between alternatives.

See EPA's position above for additional information on basis for reduced remedial design percentage compared to Head of the Hylebos project.

There are significant equipment and contracting issues associated with executing multi-year projects where tens of millions of dollars of equipment need to be mobilized to the Site. The cost estimates do not factor in the standby costs created by idle equipment for two thirds of each year while the construction window is closed.

EPA Position:
The unit costs were developed assuming conventional equipment. It is assumed that market conditions in the Pacific Northwest and utilization of this conventional equipment for other projects will minimize standby time between work windows and costs incurred for standby outside the work window would be covered by contingency. See EPA's position above for additional information on mobilization and demobilization.

In Section 4.2.2.2, EPA discusses the need for air monitoring. Air monitoring costs do not appear to be included in the cost estimate. The June 2016 FS also cites the need for fish tissue monitoring during construction which is not reflected in the costs.

EPA Position:
Site-wide monitoring is included as a capital cost in year 1 and also as a periodic cost incurred every other year for the first 10 years and every 4 years through the period of analysis. Unit costs for these monitoring efforts were developed by Anchor QEA in the draft 2012 FS, and include fish tissue monitoring. Additionally, costs for environmental monitoring during offloading at transload facility is included in the estimate for transload facility development for the duration of construction. The unit cost allowance for environmental monitoring during offloading at transload facility were developed by Anchor QEA in the draft 2012 FS, and include costs for boat, monitoring equipment and chemical analysis.

As part of ARAR discussions in Section 4.2, air monitoring is identified as required "to ensure that contaminants that volatilize would not exceed acceptable health based concentrations and adversely affect local communities and workers." Air monitoring is a minor scope component for the alternatives given that the majority of contamination in sediment throughout the Portland Harbor (PCBs, pesticides) does not readily volatilize. Location-specific needs for air monitoring (particularly PTW at the Area 6W and 7W SDUs) will be addressed during remedial design. The scope of site-specific air monitoring requirements will be identified during remedial design, and costs for these are captured in the scope contingency of the 2016 FS alternatives cost estimates given that the requirements at this time are not fully known.

LWG Dispute Issue 3
The FS fails to articulate a clear and understandable framework and schedule for implementation by which each alternative can be compared. For example, the FS states that "all the alternatives assume the remedy will be implemented as described. That is, there would be no changes identified during remedial design. However, due to the uncertainty inherent at Superfund sites, there will be adjustments made throughout the design and construction process."3 Nothing in the FS describes what adjustments are possible or how those adjustments would be determined, and, in contradiction to this assertion, EPA's prescriptive technology assignments are carried through to the Proposed Plan. Similarly, the timeframes for all alternatives are described to include a "Year 0" "initial conditions" assessment expected to take 3 to 5 years to complete, and a subsequent set of "Year 0" start-up activities, including "pre-

design investigations."4 No time is allowed in the schedule for preparation and approval of actual remedial engineering design. "Year 0" is also identified as "the first year of construction."5 Therefore, "Year 0" for all alternatives appears to mean more than 3 actual calendar years, but it is impossible to tell from the FS how many actual calendar years are rolled up into "Year 0" for any given alternative. EPA should provide a realistic vision and timeframe for implementation of its alternatives, and EPA should clearly identify in its alternatives development and decision trees that sediment management areas and technology assignments and process options will be refined and adjusted through remedial design and implementation.

The EPA June 2016 FS fails to articulate a clear and understandable framework and schedule for implementation by which each alternative can be compared.

EPA's June 2016 FS continues to be very unclear on EPA's vision for actual implementation of its selected remedy. On the one hand, it suggests in a few places that some elements of the remedy will need to be further defined or adjusted or modified during remedial design. On the other, it states definitively that the "remedy will be implemented as described. That is, there would be no changes identified during remedial design." Further, the schedule outlined by EPA for remedial implementation is impossible on its face – as discussed above, "Year 0" for every alternative contains a minimum of 4 years of activities.

Generally speaking, EPA continues to use a prescriptive set of technology evaluation and scoring criteria to determine the technologies to be applied in each area of the site. Given the deficiencies in the FS described above, and given the lack of evaluation of SDU-specific information, Figure 3.8 presents an entirely-too-prescriptive approach to technology assignments. As the LWG previously commented, EPA's approach prevents meaningful comparison of the performance of various technologies in the FS, and because the technology assignment is based on FS-level information, the prescriptive set of evaluation criteria will not appropriately or accurately predict the most appropriate technology assignments or configurations for remedial design based on data available at the time of design, including data collected post-ROD. For example, those assignments are based on overall general assumptions regarding slopes, presumed "wave zones," and required depths of removal to reach protective levels. With respect to riverbank contamination and presumed groundwater contamination, they are based solely on those general broad designations, without consideration of which COCs are present and conditions of exposure. By contrast, the Corps of Engineers capping guidance document provides design level guidance of modeling and assessment methods to determine the concentration of contaminants of concern that can be safely isolated by capping. EPA's process and these figures should build in the flexibility needed to evaluate the likely performance of technologies against RAOs in the context of the complexities of each particular SDU.

EPA should clearly explain the conditions under which changes to major alternative elements (e.g., changes in technologies assignments, methods to address PTW, methods for determining treatment and disposal requirements, requirements for rigid containment) might be considered or allowed. EPA should explain how new data, including the "initial conditions" assessment will affect the RAL boundaries based on surface sediment concentrations. The FS should include language to allow for updates to risk assessments. EPA should incorporate decision frameworks, such as the capping demonstration decision tree that was discussed during development of the

June 2016 FS. No defined processes are in place for proposing equally or more effective capping options or other technology refinements based on detailed design-level evaluations and new data. EPA should explain how the remedy would be implemented spatially (e.g., operable units, groups of SMAs) and provide transparent and reasonable disclosure of when the community can expect cleanup to actually begin.

EPA Position:

The LWG provided no regulatory or guidance support for their contention that the 2016 FS should have contained a framework and schedule for implementation. Neither the NCP nor FS guidance speaks to the need for a schedule for implementation for each alternative. The gist of the LWG's concerns appear to be more about wanting to know what the areas of flexibility may be in applying the decision trees moving into implementation because they read the 2016 FS to say that no changes to the technologies could be made in remedial design.

The LWG's concern is unfounded. The LWG took the 2016 FS quote from page 3-39 out of context and misinterpreted it. Here is the full text of the relevant FS section:

> Remedy Implementation
>
> For the purposes of the FS and developing remedial alternatives, the sequence of dredging is assumed to be from RM 11.8 to RM 1.9. However, during remedy design and construction, it may be more effective to deviate from this approach.
>
> All the alternatives assume the remedy will be implemented as described. That is, there would be no changes identified during remedial design. Due to the uncertainty inherent at Superfund sites, there will be adjustments made throughout the design and construction process." Page 3-39 of 2016 FS.

Furthermore, a word search for "remedial design" in the 2016 FS found 23 issues on which the document stated that further evaluation in remedial design would be necessary. Further, the 2016 FS acknowledges in several places that the technology assignments were **assumed** for various areas.

LWG Requested Relief #1

EPA's June 2016 FS should not be used as a basis for a Record of Decision for the Portland Harbor Superfund Site.

EPA Position:

The 2016 FS is based on good science – many principles are from LWG's draft 2012 FS, data collected by LWG during the RI phase, and consistent with the findings of the baseline risk assessments, the NCP and EPA policy and guidance for developing an FS.

LWG Requested Relief #2

The alternatives analysis in the LWG's 2012 FS provides an adequate basis for selecting a remedy at the Site.

The Disputing Respondents stand behind the LWG's 2012 draft FS, which incorporated good science, provided the required comparative analysis of alternatives, and relied on realistic estimates of cost and time to perform work. The Disputing Respondents were prepared to fully engage with EPA and resolve EPA's comments and concerns in order to produce a report that provided a credible basis for EPA's selection of a remedy that conformed to CERCLA, the NCP, and EPA guidance. EPA's unwarranted deviation from the RI/FS process agreed to by EPA in 2001 and set forth in the NCP has created a methodology that does not allow sufficient time for review, consideration and revision of the flawed FS, and is an abuse of discretion. A Record of Decision based upon the June 2016 FS will likely lead to an ineffective cleanup that cannot be implemented in a timely manner.

EPA Position:

By letter dated, December 18, 2012, EPA disapproved the LWG's 2012 draft FS and provided a list of seven significant deficiencies with the 2012 draft along with a table of 96 comments raised by the Technical Review Team. **[AR Doc # 100007297 through 100007299]** As described in the Introduction Section of this Response, EPA has been transparent and open about the modifications it viewed were needed to the LWG's 2012 draft FS and shared drafts of its modifications with the LWG over the past two to three years. The LWG has had significant opportunity to raise its concerns, which they fully took advantage of, which our administrative record demonstrates. The deficiencies EPA identified with the LWG's 2012 draft FS, not surprisingly comprise many of the issues the LWG now dispute. They even continue to dispute the background methodology that EPA's Dispute Official thoughtfully considered and documented his rationale for upholding EPA's methodology. The LWG has had significant due process to raise its issues throughout the RI/FS development, but EPA had legitimate concerns with the LWG's draft FS. The modifications that EPA made to the FS are supported by the administrative record and consistent with CERCLA, the NCP, and EPA guidance.

Contrary to their February 2016 agreement that it was appropriate for EPA to finalize the FS, the LWG complains that EPA should have worked with them to solve the problems with their 2012 draft FS and it was an abuse of discretion for EPA to have finalized the FS rather than use their draft FS. Page 22 of LWG Dispute Statement. The relief they seek is that EPA should use their 2012 alternatives analysis for selecting a remedy at the Site. Although the scope of this dispute is limited to issues about the 2016 FS, the LWG have placed at issue the quality of the alternatives analysis in their 2012 draft and whether that analysis should be used to make the remedy decision, to which we must provide a response.

As the various responses to dispute issues above have noted, EPA used a lot of the LWG's analysis from their 2012 draft FS, which at the time they submitted it, they heralded it as sufficient for decision-making. As demonstrated above, many of their problems with EPA's 2016 FS is based on their analysis they now claim is flawed or should not have been used. Apparently if the analysis is in EPA's 2016 FS its wrong, but it's fine and useable in their 2012 draft FS. The deficiencies and comments contained in EPA's December 18, 2012, letter document sufficient basis to deny the relief they now seek. Additionally, a more detailed analysis of the failings with their hydrodynamic and sediment transport ("HST") model is contained in Section 4.2.1 and Appendix H of the 2016 FS. The LWG's flawed HST model was a fundamental basis for their alternatives analysis and conclusions; therefore, any decisions based on their alternatives analysis would also be significantly flawed.

EPA has fully considered all of the issues that the LWG, collectively, as well as individually have raised on EPA's 2016 FS. Many of the LWG's issues do not even apply to the 2016 FS, but rather were issues they raised on the August 2015 draft which EPA addressed in the 2016 FS. Likewise, other concerns they raise are actually concerns about their own analysis that EPA used in developing the 2016 FS. The LWG has not provided any reason for EPA to abandon its 2016 FS. EPA complied with the CERCLA, the NCP, and EPA guidance in developing its 2016 FS and it is more than adequate for supporting a final remedy decision for the Portland Harbor Site.

SDU and Upland Site Specific Issues for Disputes

Arkema Dispute Issue 1 - Riverbank contaminants adjacent to the Arkema Site
EPA added sites and edited the discussion of riverbanks and groundwater in Section 1 of the FS. Based upon our preliminary review, the identification and presentation of these sites contain multiple errors. For example, PCBs are listed as a riverbank contaminant at Arkema, but have only been detected in a small number of samples below the applicable screening levels (with one exception, one sample slightly exceeded a conservative bioaccumulative SLV). Two key issues are: (1) risk-based PRGs should not be established based on exposure pathways being evaluated as part of the upland source control evaluations under DEQ, and (2) that none of these upland media were evaluated in the BLRAs or RI. EPA's use of sediment PRGs for riverbanks, which were applied to areas rarely inundated by the river and without considering fate and transport (e.g., attenuation), is technically unsupportable and inappropriate. Delineations of groundwater plumes and riverbanks, and a zero post-construction restoration timeframe are unsupportable.

There is a lack of data and analysis as to what risk considerations are driving the specific remedial actions (and therefore how such analyses will be refined in the design phase when further data/analysis is available) and what specific remedial actions will be implemented in which areas driven by such risks. This opaque delineation is then carried into the evaluation of alternatives and used to assess the relative effectiveness of alternatives. This appears to significantly bias the outcome of alternative selection.

The June 2016 FS fails to include a discussion of upland source controls that have been implemented as well as failing to include anything related to the performance of source controls in the remedial evaluations.

Source control measures taken at the Arkema Site have largely eliminated the stormwater pathway from this site. Groundwater controls, namely the installation of a slurry wall and a groundwater extraction and treatment system designed to prevent migration from the uplands to the river, have eliminated the groundwater pathway.

EPA Position:
See EPA's position to LWG's dispute issue 1q.

Arkema Dispute Issue 2 - Principal Threat Waste adjacent to the Arkema Site
EPA inappropriately identifies chemicals in sediment adjacent to the Arkema Site as PTW based on either a "source material," "not reliable contained," or "highly toxic" criterion. Source material has never been identified in Arkema Site sediment, EPA should not identify chemicals

that can be reliably contained as PTW, and chemicals that require long-term exposure durations through indirect exposure pathways (i.e., consumption of fish tissue) should not be identified as "highly toxic." In addition, the blanket identification of large areas with low concentrations of chemicals in sediments as PTW is neither required by the National Contingency Plan (NCP) nor necessary to protect public health or the environment.

EPA errs when it misidentifies source material based on "globules or blebs of product in surface and subsurface sediments…" and when it states that "NAPL observed in sediment cores offshore of Arkema contains chlorobenzene and DDT (dissolved)." Arkema responded to CDM Smith's 2013 memorandum (Attachment Ark-1) that purports to identify NAPL at the Arkema Site. To resolve the issue, Arkema prepared a work plan in response to EPA requests under the EE/CA Administrative Order on Consent (AOC) to confirm that NAPL was not present in sediment adjacent to the Arkema Site (Integral 2016). In addition, no samples offshore of the Arkema Site have identified the presence of an MCB DNAPL. There is no data that supports EPA's statement that NAPL observed in Arkema sediment "…contains chlorobenzene…." Significantly, a document titled "Top 10 State Issues for Proposed Plan" obtained from the LWG's Freedom of Information Act (FOIA) request identified that based on Oregon DEQ's review of the data "The multiple phases of sediment investigation have not encountered sediment exhibiting NAPL saturated conditions that would warrant thermal treatment prior to management." The status column for the same issue states that "EPA agreed to not assume NAPL at Arkema for the purposes of the cost estimate" (Attachment Ark-2). Based on these records, we conclude that EPA and DEQ agreed that there was no chlorobenzene NAPL in offshore sediments, and therefore the assertion that such sediments represent PTW Source Material as defined by EPA's PTW fact sheet is without foundation, acceptance, or support.

EPA also erred when it identified an extensive area of groundwater containing chlorobenzene DNAPL discharging to the river as "not reliable contained" (Attachment Ark-3). In fact, there is no documented MCB DNAPL groundwater plume. EPA's Figure 3.2-4, adjacent to the Arkema Site, is inaccurate and misleading. The nature and extent of chlorobenzene DNAPL in groundwater and/or sediment pore water as shown in this figure is not based on actual site data. Groundwater SCMs have been implemented at the site beginning in 2012, including an upland groundwater barrier wall and extraction and treatment system. The groundwater pathway to the river from upland areas where chlorobenzene DNAPL may have been present in upland groundwater has been isolated from site sediments. Containment has been in existence for nearly four years.

There is no scientific evidence that supports the existence of an ongoing source of MCB DNAPL to the sediment adjacent to the Arkema Site. Groundwater and pore water sampling conducted after the implementation of the SCM has not identified a MCB DNAPL source to sediment adjacent to the Arkema Site. This site characterization error which postulates an extensive area of chlorobenzene DNAPL in sediment at the Arkema Site biases the assessment and comparison of the effectiveness of alternatives as evidenced from the following text: "Alternative D has less capped area (71 acres), but does not reliably contain all PTW remaining in the river." (USEPA 2016, p. ES-15). Without an accurate assessment of PTW and PTW areas (in this case, DNAPL), EPA's alternatives evaluation is highly inaccurate.

EPA also errs when it misidentifies areas of the Arkema Site (including certain areas upstream and downstream of Arkema; Attachment Ark-3) as containing "highly toxic" PTW based on surface sediment concentrations for DDx, 2,3,7,8-TCDD, 2,3,7,8-TCDF, 1,2,3,7,8-PeCDD, 2,3,4,7,8-PeCDF, and 1,2,3,4,6,7,8-HxCDF that exceed a 10-3 excess cancer risk level for fish consumption based on the fish ingestion risks from the baseline human health risk assessment (BHHRA). This definition of highly toxic based on a long-term (30-year) exposure to a chemical substance via a fish consumption pathway is not consistent with the intent of EPA's PTW fact sheet. These 10-3 risk levels include long-term exposure parameters and indirect exposure based on a 30-year subsistence fish consumption scenario, which does not meet the definition of highly toxic (i.e., toxic under a direct contact or acute exposure scenario). Highly toxic levels should be based on direct exposure conditions only. Furthermore, the 10-3 excess cancer risk is only a suggested basis and is not prescriptive.

The EPA's proposed highly toxic PTW levels should also be considered in a broader context. EPA's highly toxic PTW values for some constituents are well below cleanup levels and screening level for unrestricted use established for other sites and scenarios. For example, the PCB PTW value of 200 µg/kg is below cleanup goals for many other CERCLA sites, which are at or above 200 µg/kg. The EPA regional screening level (RSL) for residential soil in fact is 249 µg/kg; in other words, soil/sediment with PTW levels specified in the FS could be used as clean fill at homes, schools, and day care facilities. In this context it does not make sound technical or risk management sense for the PTW level to be set at 200 µg/kg.

An approach more consistent with the intent of EPA's PTW guidance would be to set the PTW level at a 10-3 risk value based on direct contact to sediment (removal action objective 1 [RAO1]); that would be the lower of the 10-3 risk level (370,000 µg/kg), the hazard quotient (HQ) of 10 (147,600 µg/kg) (as stated in the guidance), or for the PCB case, the TSCA waste threshold (50,000 µg/kg). The use of the TSCA threshold for PCBs is also consistent with decisions at other CERCLA sites. A similar approach should be taken for the other constituents for which highly toxic PTW has been identified, especially dioxins/furans for which the PTW level in the FS is less than 3 times the EPA-recommended preliminary remediation goals PRG for dioxins/furans (once toxicity equivalence factors (TEFs) are applied).

EPA Position:
See EPA's position to LWG's dispute issue 2c and LSS dispute issue 2.

Arkema Dispute Issue 3 - Flawed evaluation used to determine whether PTW can be reliably contained

There is no scientific support for the assertion that there is NAPL or PTW in the sediments adjacent to the Arkema Site. According to EPA, PTW is a concept used in the NCP to characterize contaminant source material (USEPA 1991). PTWs are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. In the 1991 guidance, EPA stated their expectation that PTW would be treated, wherever practical, because of current technical limitations of long-term reliability of containment technologies. The long-term reliability of containment of certain NAPL PTWs has improved through the development and implementation of reactive capping, as demonstrated by EPA (USEPA 2013).

The draft final FS does consider and propose reactive capping but uses a flawed screening analysis to limit its use by designating certain SMAs as PTW NAPL/NRC, reflecting those areas where purported NAPL is deemed not reliably contained (NRC). Furthermore, the draft final FS is not consistent with the EPA guidance on principal threat and low-level threat wastes (LTW) (USEPA 1991), as it does not differentiate PTW from LTW NAPL based on toxicity, mobility, and (realistic) reliability of containment, but uses NAPL and PTW interchangeably. For instance, for shallow areas it states that NAPL or PTW that is not reliably contained within an SMA would be dredged to the lesser of the RAL concentrations or 15 feet.

To determine the boundary for where PTW can be reliably contained, two limited capping options were modeled in Appendix D to determine the maximum concentrations of PTW material that would not result in exceedances of AWQC in the sediment cap pore water after a period of 100 years. Contaminants modeled were chlorobenzene, dioxins/furans, DDx, naphthalene, PAHs, and PCBs. Appendix D contains the following errors of commission or omission:
• The objectives of the analysis are not clearly defined or stated. The document states "this appendix is evaluating whether or not PTW at the Site can be reliably contained under specific assumptions." What are the assumptions that justify a conclusion that the maximum containable sediment concentrations of chlorobenzene and naphthalene are 320 μg/kg and 140,000 μg/kg, respectively?
• The two potential active cap designs modeled (thickness of capping layers and amount of active material in cap for a reasonably conservative approach and a more aggressive augmented capping approach) are not representative of the current state of practice for reactive capping and so cannot be used to determine the contaminant concentrations that cannot be reliably contained.
• The long term reliability of a reactive cap is a direct function of the thickness of the reactive layer and the amendment(s). A more reliable reactive cap with a thickness greater than 12-inches and consisting of a lower layer of organo-clay and an upper layer of GAC should have been considered in Appendix D.
• Maximum pore water concentration of chlorobenzene used as a continuous source term in the model is based on the relatively old Remedial Investigation (RI) database and is not representative of current conditions, let alone for the next 100 years. In addition, EPA has used data that were not collected pursuant to the RI. EPA has used reconnaissance data collected using a Geoprobe rig. The data are unacceptable for, and cannot be used to represent, pore water chlorobenzene concentrations. Therefore, the maximum pore water concentration EPA used is based on inappropriate data and needs to be replaced in the model. Since the RI data collection, a barrier wall and pump-and-treat system have been installed along the shoreline of the Arkema Site. Furthermore, maximum data are not appropriate for assessing engineering performance, including reliability. A more appropriate input parameter is the 90th percentile concentration.
• A range of seepage velocities (0.3, 3, and 30 cm/day) were evaluated, representing the minimum, average, and maximum values measured at the Site. However, actual seepage velocities in SMA 7W are likely lower than 0.3 cm/day due to presence of the barrier wall and pump-and-treat system.

<u>**EPA Position:**</u>
See EPA's position to LWG's dispute issue 2c and LSS dispute issue 2.

EPA did not establish any boundaries of waste in the 2016 FS. EPA developed estimates of various types of waste to estimate costs in the 2016 FS. The figures show the extent of the evaluation based on various assumptions identified in the 2016 FS report. Boundaries and cap designs will be established in remedial design. EPA agrees that additional data collection will be required to determine the appropriate design and waste treatment and disposition requirements during remedial design.

Arkema Issue 4 - Inappropriate waste designation for sediments adjacent to the Arkema site

The assumed areas for disposal of sediment as RCRA waste (Figure 3.4-35, Attachment Ark-4) are based on a single toxicity characteristic leaching procedure (TCLP) sample for lead and no TCLP samples for chromium. Based on sediment analytical results, the area shown on Figure 3.4-35 does not represent sediment that will require RCRA Subtitle C landfill disposal. The State-listed pesticide residue designation also does not necessarily apply to sediment at the Arkema Site (Figure 3.4-36, Attachment Ark-4). As recently as February 2016, DEQ was researching the issue of whether sediment near Arkema would be designated a State-listed pesticide waste. Item 3 of the "Top 10 State Issues for Proposed Plan" document obtained from the LWG's FOIA request (Attachment Ark-2) states that "Sean needs State determination of State-only pesticide question, which Matt is researching." However, even if it is determined that some portion of the sediment is a State-listed pesticide residue waste, it would not preclude the placement of this sediment in a CDF (see HWIR discussion below) or disposal in a Subtitle D landfill out of state. When a State-listed hazardous waste is transported out of state (for example, to the Roosevelt Regional landfill as presented in the FS), the Oregon State waste designation no longer applies, and the waste can be disposed as a non-hazardous waste so long as it meets other landfill disposal criteria. This was recently demonstrated by the disposal of soil from the Arkema Stormwater and Groundwater SCMs, at the RCRA Subtitle D Roosevelt landfill in Washington.

Arkema disagrees with the cost assumption that "cement solidification/stabilization, low temperature thermal desorption, and no treatment will be used in equal proportions to treat pesticide/chlorobenzene PTW" for the disposal of dredged sediment that meets EPA's PTW criteria from the Arkema Site. Notwithstanding the fact that there are no PTW sediments currently identified off the Arkema Site, the FS fails to clearly outline the basis for EPA's assumptions regarding treatment as a prerequisite for offsite disposal. Section 3.2.2.3 fails to clearly identify specific regulations and the conditions under which they are assumed to apply, or not apply, to sediments that are designated as PTW and the mechanism under which they derive need for treatment prior to offsite disposal. Furthermore, the "Top 10 State Issues for Proposed Plan" document obtained from the LWG's FOIA request (Attachment Ark-2) states that "DEQ wants to be clear that land disposal of these sediments does not require treatment under Oregon Administrative Rules." As presented, EPA has arbitrarily made more conservative assumptions for disposal of PTW defined by sediments purportedly containing DDx and NAPL than it has for PCBs, dioxin/furans, and PAHs.

EPA Position:

See EPA position to LSS dispute issue 3.

Arkema Dispute Issue 5 - Inappropriate application of the Hazardous Waste Identification Requirements (HWIR) Rule for disposal of sediment in a CDF

EPA asserts that "Dredged material subject to requirements of a permit that has been issued under Section 404 of the CWA is excluded from the definition of hazardous waste (40 CFR 261.4(g)). This provision is discussed in the Hazardous Waste Identification Rule (HWIR) (63 Federal Register [FR] 65874, 65921; November 30, 1998). Oregon State adopted the HWIR rule in 2003. This rule means that RCRA regulatory requirements do not apply to sediment dredged at the Site and disposed of on-site, such as at the Terminal 4 CDF, if the material otherwise meets the CDF acceptance criteria." (emphasis added)

EPA has correctly stated that RCRA regulatory requirements, including the designation of waste sediment as either a Federal or State-only hazardous waste, do not apply to sediment placed in a CDF; however, the statement mischaracterizes the CWA requirement that the sediment must meet CDF acceptance criteria for this rule to apply. This is not the case. Because DEQ has adopted the federal HWIR rule, and the CDF would meet CWA Section 404 requirements, RCRA Subtitle C requirements would not apply, and the dredged material placed in the CDF would not be a hazardous waste. The disposal of Arkema sediment in a Terminal 4 CDF should, therefore, be considered. The failure to consider CDF disposal for Arkema dredged sediment artificially inflates the disposal costs for alternatives related to the dredging at the Arkema Site. EPA disregards the scope and intent of the HWIR Rule by placing arbitrary restrictions on what EPA believes can be placed into the T4 CDF if constructed. All of the EPA's Acceptance Criteria for the T4 CDF are arbitrary and should be removed. Disposal of dredged material should follow the HWIR Rule as adopted by the State. This arbitrary action by EPA has severe negative implications for the FS and any subsequent RA.

EPA Position:

See EPA's position to LSS dispute issue 4.

Arkema Dispute Issue 6 - Inappropriate use of PCB non-detected values in RAL and PTW footprint maps

The RAL and PTW footprint maps incorporate data with high PCB detection limits adjacent to the Arkema Site (Attachment Ark-5). The high PCB non-detects with detection limits 5 times EPA's PTW value (e.g., >1 mg/kg) occurred in the Aroclor analysis as a result of a matrix interference with DDx. The RAL and PTW footprint maps should only consider detected PCBs based on PCB congener concentrations adjacent to the Arkema Site. The identification of PTW and remediation footprints for PCBs adjacent to the Arkema Site based on non-detect values with elevated detection limits resulting from matrix interference with DDx is inconsistent with EPA's PTW guidance and biases the assessment of PTW and remediation footprints for the SDU RM7W alternatives. This exaggerated PCB footprint will also bias the alternative selection for SDU RM7W.

EPA Position:

See EPA's position to LSS dispute issue 6.

Arkema Dispute Issue 7 - Inaccurate RAL and PTW footprint maps

The PCB and PCDD/F RAL and PTW maps were contoured using natural neighbors gridding and did not account for the flow direction or depositional environments in a river system. The

RAL and PTW maps in EPA's FS used nearest neighbor interpolation, and data points were inappropriately interpolated through upland areas. An example of this inappropriate interpolation is between points in the Willbridge Terminal and the area between Dock 1 and the Salt Dock on the Arkema Site (Figures 3.4-7, Attachment Ark-5; 3.4-11, Attachment Ark-6). In this example, the points are not correlated and should not be interpolated through the upland portion of the Arkema site. The RAL and PTW maps must include some interpretation to reflect the physical features of the site and site uplands, as well as the hydrodynamics of a river system.

EPA's Position:
See EPA's position to LSS dispute issue 6.

Arkema Dispute Issue 8 - Background concentrations for PCDD/F compounds in sediment
Sediment PRGs for RAO2 and RAO6 as well as riverbank PRGs for RAO9 for the five PCDD/Fs congeners are based on background concentrations. Background PCDD/F concentrations for individual congeners are presented in Appendix B, Table B2-4 of EPA's FS.

EPA uses new methods for deriving these levels that appear significantly different from both EPA's methods for other chemicals as well as past LWG input on this subject. Sediment PRGs for RAO2 and RAO6 as well as riverbank PRGs for RAO9 for the five PCDD/Fs congeners are based on background concentrations.

The background values are based on limited and poor quality data (with elevated detection limits). In fact, only one congener has sufficient data (1,2,3,4,7,8-HxCDF) to calculate a background value and even that is limited (13 of 31 samples were non-detects). Thus, most of the background "values" are based on a 95% UCL of the detection limits. The background values also appear skewed quite low compared to other urban watersheds.

The background values estimated based on this limited data and approach, furthermore, are approximately an order of magnitude lower than values from other regions and watersheds. For example, a memorandum published by EPA in 2010 provides a good summary of background levels for dioxins/furans in sediment, which range from approximately 2–5 parts per trillion (ppt) as TEQs. It also summarizes values from Puget Sound which include a TEQ value of 4 ppt for non-urban areas but allowing up to 10 ppt as TEQs for open water disposal; this value is also used in San Francisco Bay and elsewhere. (https://klamathrestoration.gov/sites/klamathrestoration.gov/files/EPA%20Klamath%20dioxin%20memo%201-13-10%20final.pdf). The Duwamish Waterway FS establishes an upper bound background value for dioxins/furans as 11.6 ppt TEQ.

Background values in other regions and watersheds are expressed as TEQs, which is generally the manner in which cleanup goals for dioxins/furans are expressed. For Portland Harbor, EPA used 5 individual congeners. The individual congener background values provided in Appendix B of the FS and in the PRG tables for RAOs 2 and 6 can be converted to TEQs using TEFs, which results in a value of 0.56 ppt on a TEQ basis (since the 5 congeners equate to the majority of the risk, this value may be slightly biased low, but probably less than 10% of the total TEQ). This background value is an order of magnitude or more lower than the range of values, mainly for non-urban areas, from the literature. A study to better define background levels for dioxins/furans is necessary since the calculated risk-based PRGs are well below even these low-

biased background levels resulting in the background values being adopted as the final PRGs. Otherwise, it is unlikely that the remedies for dioxins/furans will be successfully implemented and estimated risk reductions for dioxins/furans will be realized. This latter issue addresses the validity of the alternatives analysis and its biased outcome.

It should also be noted that no background values are listed for RAOs 1 or 3. Those PRGs are expressed as TEQs and data is lacking to identify a background level on a TEQ basis. Those PRGs may be below background. In fact, the PRG for RAO3 is four orders of magnitude below the MCL and is likely not reliably measurable at that level. Overall, providing PRGs that are below MCLs is inconsistent with other cleanup actions under CERCLA or other programs. Cleanup to below MCLs is unlikely to be achievable.

<u>EPA Position:</u>
See EPA position to LWG dispute issue 1h and LSS dispute issue 11a.

<u>Arkema Dispute Issue 9 - Background Concentrations in other COCs and media</u>
The FS (Section 2.2.2.4) states that only sediment background concentrations were estimated and background concentrations for other media could not be calculated due to insufficient data. However, surface water background concentrations were calculated in the RI. Upriver surface water background concentrations of COCs are orders of magnitude higher than the ARARs based on the AWQC. Note, the background UCLs for upriver surface water (dissolved concentrations with outliers removed; Table 7-4b of RI) vs RAO3 AWQC-based PRGs. For example, the background concentrations and ARARs for DDT, PCBs, and TCDD TEQ demonstrate examples of RAOs that are less than background:
• background UCL for DDT = 0.000114 μg/L and the ARAR (RAO3) is 0.00002 μg/L;
• background UCL for PCBs = 0.000126 μg/L and the ARAR (RAO3) is 0.000006 μg/L; and
• background UCL for TCDD TEQ = 0.000126 μg/L and the ARAR (RAO3) is 0.000000033 μg/L.
Because of the deficiencies in determining the background levels, a new background study for sediment, surface water and tissue needs to be conducted in the design phase. The results of this evaluation need to be used to update PRGs, RALs and SDUs.

<u>EPA Position:</u>
See EPA's position to LWG dispute issue 1g and LSS dispute issue 11b.

<u>Arkema Dispute Issue 10 - Benthic risk models do not honor the measured data</u>
EPA made extensive changes to the benthic approach for this FS, but those changes are still inconsistent with the comprehensive benthic risk approach contained in the approved BERA. The FS states:
"The protection of benthic species to contaminated sediment is evaluated using the benthic risk area defined by an order of magnitude greater than the RAO5 PRGs. The post-construction interim target for RAO5 was established at 50% reduction in the area posing unacceptable benthic risk." So, instead of using the CBRA, EPA now maps benthic PRG exceedance factors on a point-by-point basis and uses a 10 times exceedance factor to identify areas of concern. EPA then concludes that if 50% of this area is actively remediated, the alternative is "protective" on an interim basis. It is unclear how this new method is: (1) more accurate or consistent with the

BERA, or (2) more predictive of benthic risk or the effectiveness of the alternatives, as compared to simply using the CBRAs, which are entirely consistent with the BERA.

Furthermore, and most importantly, the benthic risk models used by EPA do not honor the measured data. Although the LRM and FPM are model predictions using data from the toxicity texts conducted with site sediments, much of the measured data is not considered or addressed in this evaluation. Any modeled risk for benthic invertebrates that ignores actually toxicity testing results needs to be assessed in weight-of-evidence and river-mile specific decision-making. The benthic risk footprints should not extend into areas shown to have a lack of toxicity based on actual laboratory toxicity tests. This error has been carried through the alternatives analysis and therefore has biased the selection of alternatives for SMAs in the FS.

EPA Position:
See EPA Position to LWG dispute issue 1b and LSS dispute issue 12.

Arkema Dispute Issue 11 - Overly prescriptive decision trees
The FS acknowledges uncertainties in site characterization and the conservative assumptions used to form the basis for associated technology assignments, however EPA continues to use a prescriptive set of technology evaluation and scoring criteria to determine the technologies to be applied in each area of the site and, with the exception of a vague paragraph in Section 3.8.1, the FS is silent regarding the degree of flexibility that is envisioned to be available during remedial design to refine technology assignments based on the additional information gained through future pre-design investigations. This will lead to a lack of flexibility with regard to technology assignments, depth of removal, potential improvements in technology, design efficiencies to address remedial, and CWA/ESA requirements, among other things.

EPA should clearly explain the conditions under which changes to major alternative elements (e.g., changes in technologies assignments, methods to address PTW, methods for determining treatment and disposal requirements, requirements for rigid containment) might be considered or allowed. EPA should explain how new data, including the "initial conditions" assessment, will affect the RAL boundaries based on surface sediment concentrations. The FS should include language to allow for updates to risk assessments. EPA should incorporate decision frameworks for proposing equally or more effective capping options or other technology refinements based on detailed design-level evaluations and new data.

EPA Position:
See EPA's position to LSS dispute issue 14.

Arkema Dispute Issue 12 - Prescriptive dredge residuals management strategy
The prescribed application of 12-inches of sand across the entire dredge footprint (amended with AquaGate+PAC in areas where PTW present) is poorly supported. The FS is misleading in stating that the placement of sand (and GAC in areas where EPA has speculated that PTW is present) immediately following dredging will eliminate the need for additional dredge passes. The FS indicates that sediment cores would be taken post-placement to verify that thin-layer residual cover successfully reduces residuals concentrations. It is inappropriate to assume a 12-inch layer of residuals management cover will be applied across the entire dredge footprint,

without providing a strategy that will determine the necessity for thinlayer placement and flexibility to develop an appropriate thickness.

As PAC can be toxic to benthic organisms, overall quantities and where and how it is applied warrants more thoughtful consideration. The FS neglects to consider the physical stability of PAC in the deployment of the thin-layer residuals cover. PAC will be ineffective if it immediately washes away. The FS neglects to consider any possible unintended consequences that may be posed by transport/erosion and aggregation of PAC (with or without adsorbed contamination) in depositional areas. The assumed performance requirements for this residuals strategy are unclear.

EPA Position:
See EPA's position to LSS dispute issue 15.

Arkema Dispute Issue 13 - Inappropriate use of rigid containment technologies
EPA assumes the use of sheet pile barrier walls as dredge water quality control measures based on the suspected presence of NAPL will support the short term effectiveness of all alternatives. The FS still fails to adequately evaluate the implementability, effectiveness, and cost of this particular technology relative to other technologies and BMPs.
In making gross assumptions for this FS, EPA has disregarded the complexity of constructing such barrier walls (e.g., consideration of structural components such as king piles and structural bracing, or more complex cofferdam structures) and the associated impacts this will have on numerous aspects of remedy implementation ranging from construction duration (e.g., time required to install walls, and impacts to dredge production rates) to the overall net benefit and cost effectiveness relative to other means. EPA also continues to show figures that depict sheet piling in greater than 50 feet of actual water depth, which is technically infeasible. These figures also imply that sheet piles will be installed in the navigation channel, which would infeasibly obstruct vessel traffic. Sheet pile would also impact ongoing water dependent operations and nearshore fish migration does not evaluate whether sheet piles in the navigation channel could be permitted by USACE.

EPA Position:
See EPA position to LSS dispute issue 16.

Arkema Dispute Issue 14 - Risk reduction between alternatives
The calculated post-construction risks and HI values are higher than the interim target risks and HI. Because much of the remedy relies on MNR, the lack of a residual risk estimation process for time intervals post-construction (up to year 30) limits the usefulness of the residual risk estimates in terms of comparing the protectiveness of the remedies.

Furthermore, there is very little difference in net risk reduction between Alternatives B and I for almost all COCs. For most of the COCs, the differences are less than a factor of 2 and sometimes much smaller (e.g., difference in HQ of 0.25). Given the very conservative assumptions that were used to calculate PRGs, differences in estimated risks by a factor of 2 or less are not significant. A more reasonable criterion for evaluating differences in estimated risk between alternatives would be a factor of 10, which should be considered the minimum significant difference given the limited sensitivity of these criteria. A probabilistic-type risk *evaluation, which incorporates the quantitative uncertainties, would be a more appropriate approach.*

This small difference in risk reduction between alternative remedy scenarios is likely due to the driving PRGs being based on background. The risk associated with background levels of COCs should be presented in a side-by-side comparison to the residual risk estimates in order to demonstrate the benefit of the remedial measures to the public. Based on the residual risks presented, any remediation beyond Alternative B (which does show a great degree of risk reduction from Alternative A, no action, than the difference between other alternatives) is unwarranted. The very large increase in costs for minimal and insignificant risk reduction between Alternatives B and I is not recognized in the FS.

In summary, the removal volumes in Alternative I cannot be justified as a cost-effective reduction of risk in comparison to other alternatives. Nor can the use of mixed criteria such as PRGs (and RALs) from different alternatives (i.e., "E" and "F" applied either site-wide or within an SMA) be justified based on differences in risk outcomes that are within an order-of-magnitude.

EPA Position:
See EPA's position to LSS dispute issue 8.

Evraz Dispute Issue 1 - EPA's Feasibility Study improperly imposes more stringent remedial action levels (RALs) in some areas of the site than others.
EPA established a range of RALs based on the distribution of surface sediment contamination. In some areas of the site its preferred alternative (Alternative I) selects "Alternative B+PTW" or Alternative D RALs. However, in other areas of the site, including adjacent to EVRAZ's Rivergate mill, Alternative I selects "Alternative E" RALs. This leaves higher concentrations of PAHs and dioxins in some portions of the river. There is nothing in the FS that describes why, if the "Alternative B +PTW" or Alternative D RALs are protective in some portions of the river, they are not equally protective in other areas. One specific example where the use of Alternative E RALs drives remedial action to a lower concentration than other areas is the remedial footprint near outfall OF53A. It is unclear why additional risk reduction is necessary at this location. For dioxin, sufficient data is not available to support such a decision. EVRAZ believes the FS is flawed in applying different levels of protectiveness, and that its site should similarly be remediated to "Alternative B+PTW" RALs.

EPA Position:
The SDU specific evaluations for each of the alternatives provides the evaluation of each alternative in various portions of the river (see Section 4 of the 2016 FS). Based on evaluation of how each alternative performed in achieving interim goals and PRGs, some areas achieved those goals in some alternatives, while they were not achieved in other areas. This is due to the variability in the contaminant releases to the Site and the distribution of contamination in sediments in various portions of the Site. However, EPA is applying the same levels of protectiveness everywhere consistently throughout the Site – the interim goals and PRGs are consistent. What is different is the concentration of contamination that needs to be capped or dredged in order to meet those protective levels. For Alternative I, Alternative E RALs were selected in SDU 2E to address all PTW and achieve interim targets for all RAOs in this area of the Site.

<u>Evraz Dispute Issue 2 - Failure of FS to account for riverbank remedial actions already implemented, with EPA's approval.</u>

The FS is based on inaccurate information in that it ignores that EVRAZ already implemented a riverbank remedial action for its Rivergate property, a remedial action based on a source control decision made by the Oregon Department of Environmental Quality and concurred with by EPA. Assumed riverbank cleanup extents are used in the overall protectiveness determination and without basis.

<u>EPA Position:</u>

See EPA's position to LWG's dispute issue 1q.

<u>Evraz Dispute Issue 3 - Inadequacy of "groundwater plume" conclusions.</u>

In addition to the concerns raised in the main text of the document, EVRAZ disputes the following issues with respect to EPA's description of what it depicts as a "groundwater plume" adjacent to EVRAZ's Rivergate property.

a. For arsenic, this should not be a plume as concentrations in beach groundwater are within the range of or below site background values, do not exceed benthic toxicity criteria and groundwater discharges do not adversely affect the water column.

b. For manganese, this should not be a plume at all because it does not include site-specific hardness for ecological values and the basis for the human health PRG is application of tap water Regional Screening Levels (RSLs) for manganese in groundwater. As explained in the main text of the document, RSLs are not appropriate PRGs for groundwater in these circumstances.

c. The exposure pathway of concern is in the surface water to which the groundwater discharges. Surface water concentrations here meet the surface water PRG for manganese.

d. Groundwater plumes are used in the overall protectiveness evaluation and overestimation of plume extent skews the metrics.

<u>EPA Position:</u>

The 2016 FS identified COCs for groundwater plumes based on information provided by ODEQ. See EPA position to LWG issue 1q.

There has been limited sampling to characterize the nature and extent of the groundwater plumes offshore of the Evraz facility. Further, there have been no source control actions taken at this property to control the groundwater plumes. Contaminants of concern in groundwater are arsenic and manganese based on information provided by ODEQ. **[AR Doc # 1469786 and 1469793]** Thus, these contaminants will be monitored in pore water during remedial design to ensure that the pore water is not impacted such that a reactive layer in a cap or some other upland control may be necessary to ensure PRGs are achieved. The ecological PRGs for manganese were developed based on site-specific hardness values. **[AR Doc # 100005457]**

See EPA position to LWG dispute issue 1d, 1m and 1n.

<u>Gunderson Dispute Issue 1 - Failure to Account for Completed Riverbank Source Control Measures</u>

The FS ignores Gunderson's extensive source control work implemented under the oversight of the Oregon Department of Environmental Quality (DEQ) under Voluntary Cleanup Agreement No. WMCVC-NWR-94-01 and Consent Order No. LQVC-NWR-13-02, and in accordance with the requirements set out in the DEQ-EPA Portland Harbor Joint Source Control Strategy (JSCS; DEQ, 2005). Gunderson has implemented permanent riverbank source control measures at some riverbank areas that are identified by EPA as needing remediation. Gunderson has also completed interim source control measures under DEQ oversight at the remainder of the riverbank areas that are identified by EPA in the FS and agreed with DEQ that additional permanent measures will be implemented concurrent with the adjacent in water remedy.

EPA Position:
See EPA Position to LWG dispute issue 1q.

Gunderson Dispute Issue 2 - "Groundwater Plume" Conclusions Are Inaccurate and Contradictory to Conclusions of the RI
The FS depicts two groundwater plumes (referred to herein as the "Southeast Plume" and the "Northwest Plume") adjacent to Area 1 of the Gunderson facility. Gunderson disputes the following issues with respect to the EPA-depicted groundwater plumes.
a. EPA provides no clear rational for depicting the locations and extents of the plumes at the Gunderson facility (and elsewhere in the Portland Harbor).
b. During extensive investigations conducted under DEQ oversight, there has never been any evidence that the so-called Southeast Plume exists now, or ever approached anywhere near the river either before or after it was subjected to remediation by sparging.
c. The depiction of the Northwest Plume is contradictory to the conclusions of the EPA approved RI, "The data suggest that ongoing migration of the chemicals to the TZW via groundwater discharge does not contribute to significant concentrations of COIs in nearshore TZW sediments."
d. The Northwest Plume was delineated because VOC concentrations in near shore TZW exceeded human health screening levels based on the ingestion of Willamette River water. TZW remediation standards based on the consumption of Willamette River water are not appropriate.
e. The contaminants detected in a small area of transition zone water have not been detected in surface water.
f. The December 2007 Round 3 Groundwater Pathway Assessment Field Sampling Report for Stratigraphic Covering – Gunderson, Prepared for the Lower Willamette Group and submitted to EPA by Integral Consulting concluded that "the stratigraphic information does not indicate a conductive pathway for any remnant TCA plum…. On November 8, 2007, EPA indicated to the LWG Management Team that the agencies concurred that the stratigraphic information did not indicate the need for follow-up TZW sampling."
g. The analytical data that serve as the apparent basis for EPAs delineation of the Northwest Plume were collected more than ten years ago. VOCs in upland groundwater have exhibited long-term decreasing trends, even prior to active treatment, which began in 2007. Based on these trends and the low residual concentrations of VOCs in groundwater, DEQ authorized deactivation of the groundwater treatment system for this plume in 2014. There is no evidence that it posed any current threat to sediments or porewater.

EPA Position:

Groundwater plumes were identified in the RI Report, Section 4 and Appendix C2 (see Figure 4.4-10a-c, Map 4.4-3a-h, and Table 4.2-2). There has been limited sampling to characterize the nature and extent of the groundwater plumes offshore of the Gunderson property. Further, there have been limited source control actions taken at this property to control the groundwater plumes. Contaminants of concern will be monitored for in remedial design to determine whether the pore water is impacted such that a reactive layer in a cap or some other upland control may be necessary to ensure PRGs are achieved.

See EPA position to LWG dispute issue 1d, 1m and 1n.

NW Natural Dispute Issue

On September 27, 2012, EPA provided a preliminary set of comments on the Gasco EE/CA stating that "any comments provided on the Gasco EE/CA are preliminary as the Gasco EE/CA is so heavily dependent on the Portland Harbor draft FS…. Therefore, comments provided on the Portland Harbor draft FS may also need to be addressed in the Gasco EE/CA." Pursuant to EPA's February 4, 2016 agreement with the Lower Willamette Group, EPA is finalizing the Portland Harbor FS rather than providing comments. Many of the modifications EPA has made in the June 2016 FS are inconsistent with the terms of the Gasco Consent Order and with the information, analyses and conclusions of the Gasco EE/CA.

EPA Position:

The effect of the 2016 FS on the Gasco Consent Order is beyond the scope of this dispute.

NW Natural Dispute Issue 1 - Risk Reduction and Risk Management

In the September 9, 2009 Administrative Settlement and Agreement and Order on Consent for the Gasco Sediments Site (the "Gasco Consent Order"), EPA and NW Natural specifically agreed to use risk management principles and the results of the harborwide risk assessment to define areas for and approaches to cleanup that are based on significant risk reduction.

> *"This SOW's goal is to design a remedy consistent with the ROD that will reduce key human and ecological risks cost effectively given Site characteristics, which results in a cleanup that is protective of public health and the environment and meets all federal and state applicable and relevant and appropriate requirements (ARARs). The risk lines of evidence used in the ROD will guide risk management for the Gasco Sediments Site. The design will also use a risk management framework consistent with EPA guidance (EPA 2005 and EPA 1988) on developing sediment remedies and specifically recognizes the risk management goals for the project throughout the evaluation and design process. The risk management related approaches that are specifically important to this project and are consistent with guidance include:*
> *• The Gasco Sediments Site cleanup boundary will be consistent with Portland Harbor EPA approved BLRA.*
> *• Evaluate remedial alternatives with regard to total net risk reduction within the overall framework of the NCP remedy selection criteria.*
> *• Use the Portland Harbor risk assessment protocols, procedures, data, and outcomes whenever possible to set clean up boundaries and evaluate risk reduction, unless use of these would cause an unacceptable delay to the Gasco Sediments Site remediation."57*

As more fully described in the LWG's comments on the EPA August 2015 draft FS and the main text of this document, EPA's FS is not consistent with either the approved baseline risk assessments for Portland Harbor or a risk management approach focused on the reduction of key human and ecological risks at the site. In particular, NW Natural objects to EPA's use of TPAH RALs and PRGs, the use of which are inconsistent with the findings of the approved BHHRA and BERA, are technically unsupported, and result in significant mass removal unrelated to any measurable reduction in risk.

cPAH PRGs and RALs (expressed as BaPEq) were developed under EPA oversight for the LWG's March 2012 draft FS and were used in NW Natural's March 2012 draft Engineering Evaluation and Cost Analysis for the Gasco Sediments Site (the "Gasco EE/CA"). BaPEq is consistent with the methods and results of the Portland Harbor BHHRA, which were assessed in terms of total cancer risk from cPAHs on a BaPEq basis. The risk-based approach called for in the guidance6 specifies that RALs should be consistent with the methods and findings of the BLRAs to ensure that sediment remedies are "risk-based" (i.e., result in effective risk reduction).

The EPA June 2016 FS itself is consistent with this and expresses all human health PAH PRGs as BaPEq. Therefore, use of BaPEq RALs clearly allows for a direct comparison on a consistent basis between the RALs and the PRGs. Using TPAH RALs does not allow for a direct relationship between RALs and PRGs. In fact, using a TPAH PEC for protection of benthic exposure is not only inconsistent with the approved BERA but is particularly inappropriate for the Gasco sediments site, where NW Natural has invested considerable effort and expense (under EPA oversight) in evaluating the multiple lines of evidence approach defined in the Gasco Consent Order as the basis for identifying areas requiring active remediation consistent with the BLRAs.58

NW Natural further objects to the application of TPAH (or BaPEq) RALs within the navigation channel. cPAH risks related to sediment direct contact and shellfish consumption exposures occur only outside the navigation channel (along the shoreline), and as a result, BaPEq RALs associated with these potential risks should be applied in exposure pathway areas only. Although some potentially unacceptable cPAH risk from fish consumption was identified in the BHHRA, EPA was unable to develop any valid relationship between cPAH fish tissue and sediment concentrations at the Site, or any other sediments site, due to the rapid metabolism of PAHs by vertebrate fish.59 Carcinogenic PAHs represent less than 1% of the cumulative risks to people eating fish and are, therefore, not a technically valid reason to significantly expand the remedy on the basis of a technically inappropriate PRG, given that there is no reasonable expectation that such an expansion could have any meaningful impact at all on the overall fish consumption risk. It is critical to note that if the shellfish consumption PRG EPA has proposed to use as a surrogate for fish consumption were applied at the same fish exposure scale as EPA used in the BHHRA (whole river mile rather than one-third transect river mile), all remedial alternatives (other than no action) evaluated in the Gasco EE/CA would attain the PRG without application of TPAH or BaPEq RALs in the navigation channel.

TPAH or BaPEq RALs can only be linked to effective risk reduction along the shoreline (using the BHHRA findings and the resulting appropriate PRGs for sediment direct contact and shellfish consumption). If inappropriately applied to the navigation channel, where the risk pathway does not exist, the remedy would cost perhaps hundreds of millions of dollars more, yet *result in no additional risk reduction. These RALs should therefore only be used only along the shoreline outside of the navigation channel where the exposure pathway is complete. The multiple lines of evidence (LWG Comprehensive Benthic Risk Area) approach outlined in the Gasco Consent Order and consistent with the BERA is appropriate for protection of ecological receptors and NW Natural respectfully requests that it be used by EPA for remedial decisions in that area.*

EPA Position:
See EPA position to LWG dispute issue 1d.

NW Natural Dispute Issue 2 - Future Source Material
EPA's identification of "globules or blebs" of NAPL as "source material" constituting "principal threat waste" (PTW) at the Gasco Sediments Site is inconsistent with the more specific definition of "potential future source of risk material" in Section 3.2 (RAO 1) of the Gasco Consent Order Statement of Work through the delineation of "substantial product." Section 3.6.2.1 of the Gasco SOW states:

> *"Areas with substantial presence of product in sediments is a line of evidence related to potential mobility of chemicals in the future, and thus related to risks identified in the BLRA. Visual observations in sediment cores shall be the primary parameter used for this line of evidence. As noted above, the term "substantial" product is intended to 1) target product that is related to potential future mobility and 2) indicate a preference for removal as defined by RAO #1. The definition of substantial product does not include every incidence of product observation at the site."*

Section 3.6.2.1 goes on to provide more than a page of detail on the precise physical characteristics of material that EPA will consider sufficiently mobile to constitute source material. Based upon this definition, NW Natural has conducted multiple field investigations at a cost of several million dollars to delineate the location of "substantial product" at the Gasco sediment site. These investigations were used to complete detailed and site-specific remedial alternative evaluations in the Gasco EE/CA.

The June 2016 FS does not explain why EPA has apparently abandoned the more specific and technical definition of "substantial product" in favor of "globules and blebs" or why "globules and blebs" is a superior approach for identifying material that presents a significant source of future risk. In the absence of any technical justification, and given the substantial resources NW Natural has put into complying with EPA's original direction on the identification of potential future source material, EPA's change of course is arbitrary and capricious.

NW Natural respectfully requests that EPA abide by the more specific and technically sound definition of "substantial product" contained in the Gasco Consent Order.

EPA Position:
The NCP and EPA guidance uses the terms "source material" and "principal threat waste", not "substantial product." Any material that is highly mobile as analyzed in the 2016 FS is principal threat waste. It is expected that substantial product as defined in the Gasco order matches up with

and is consistent with the highly mobile PTW identified in the 2016 FS. The 2016 FS is being consistent with the NCP and EPA guidance.

NW Natural Dispute Issue 3 - Remediation Waste

EPA's June 2016 FS identifies a category of remediation waste called "Waste or Media Containing Waste that May Warrant Additional Management." EPA states that "Waste with this designation may be specially managed as a non-hazardous waste at a Subtitle C facility based on the exceedance of TCLP criteria for MGP-related constituents and/or special considerations such as worker safety and equipment decontamination. However, if the material is treated and TCLP criteria are no longer exceeded after treatment, it may be disposed of in a RCRA Subtitle D facility."

NW Natural agrees that MGP-related remediation waste that exceeds TCLP criteria at the time it leaves the site will be disposed of as non-hazardous waste at a Subtitle C facility. This material is identified as "Special Waste" under the Gasco Consent Order. To the extent, however, that EPA's June 2016 FS indicates that it may require MGP-related remediation wastes that do not exceed TCLP criteria to be disposed of at a Subtitle C facility based on other "special considerations," that requirement would be inconsistent with the Gasco Consent Order, which provides

> *"The method to determine that MGP-related material should be managed as a Special Waste shall be based on the absence of TCE and associated CVOC chemicals and exceedance of TCLP criteria for any MGP-related constituent. If TCLP criteria are exceeded at the time the material leaves the Site, then the material shall be designated Special Waste and transported to a Subtitle C facility. If not, the material would be disposed of as Cleanup Material at a Subtitle D facility [permitted to accept the material].*

This method applies to both untreated and post treatment materials, if treatment is proposed. Consequently, an untreated material may meet this definition, but, upon treatment may be determined to no longer meet this definition. In the event that treatment, including treatment in barges, changes the definition, the material would no longer be designated a Special Waste."

The June 2016 FS goes on to state that EPA is assuming "for FS cost purposes" that Gasco remediation wastes identified as PTW "would exceed the TCLP criteria and would need cementbased solidification treatment prior to disposal in a Subtitle C disposal facility."
NW Natural respectfully requests that EPA clarify that, consistent with the Gasco Consent Order (and text earlier in the same paragraph in the June 2016 FS), material that either does not exceed TCLP criteria or that is treated so that TCLP criteria are not exceeded may be disposed of in an appropriately permitted Subtitle D facility.

EPA Position:

EPA's 2016 FS was clear what the assumptions were about disposal of MGP wastes and the need for treatment, and that if TCLP criteria are no longer exceeded after treatment then dredged MGP wastes could be disposed of in a RCRA Subtitle D facility. The 2016 FS page 3-29 stated:

Waste or Media Containing Waste that May Warrant Additional Management

> MGP wastes are by definition not RCRA hazardous wastes per 40 CFR §261.24(a), which specifically excludes solid MGP waste. While MGP wastes are exempted as a RCRA hazardous waste, concerns about the toxicity and mobility of the material prompted EPA to classify these materials as a "Waste or Media containing Waste that May Warrant Additional Management" at the Site so the contaminated sediment could be appropriately handled and managed. Waste with this designation may be specially managed as a non-hazardous waste at a Subtitle C facility based on the exceedance of TCLP criteria for MGP-related constituents and/or special considerations such as worker safety and equipment decontamination (USEPA 2004, 2005). **<u>However, if the material is treated and TCLP criteria are no longer exceeded after treatment, it may be disposed of in a RCRA Subtitle D facility.</u>** It was assumed for FS cost purposes that the MGP waste identified as PTW NAPL/NRC at the Gasco former MGP facility would exceed the TCLP criteria and would need cement-based solidification treatment prior to disposal in a Subtitle C disposal facility. (emphasis added)

<u>NW Natural Dispute Issue 4 - Site-Specific Technology Assignment and Evaluation</u>

The Gasco Consent Order provides for evaluation of "a range of technologies including dredging, capping, and Monitored Natural Recovery (MNR). Alternatives will include combinations of technologies that are tailored to the physical, chemical and other conditions of the Site." By contrast, the EPA June 2016 FS assigns prescriptive technologies based upon generalized decision trees. The EPA alternatives do not allow evaluation of the comparative effectiveness of various combinations of technologies applied within the same area of the site – the only difference among the EPA FS alternatives is the size of a single applied technology.

The combination of technologies that will attain the best balance of risk reduction and cost effectiveness at any specific location is highly site-specific. EPA's remedy selection must allow for technology adjustment and refinement through the incorporation of the types of site- specific information considered in the Gasco EE/CA but not carried forward into EPA's June 2016 FS. EPA has not provided any rationale for its decision not to import the more refined technology evaluations of the Gasco EE/CA into the FS (or into the Proposed Plan, for that matter). EPA should, at a minimum, clarify how technology assignments will be refined and adjusted during remedial design and implementation. The draft capping demonstration decision tree EPA provided to NW Natural in November 2015, for example, would be an appropriate sort of tool to illustrate how EPA intends to make refinements based on site-specific data or other remedial design information. EPA's decision not to incorporate such tools into the June 2016 FS or the Proposed Plan is a major contributor to our inability to understand EPA's vision for how cleanup will actually be designed and implemented, especially if additional data collection leads to a change in our understanding of site conditions.

NW Natural also objects to EPA's decision to assign remedial technologies at Gasco that ignore the documented performance of the upland hydraulic control & containment system installed under Oregon DEQ oversight and in close coordination with EPA. Similarly, the June 2016 FS provide does not discuss or consider the integration of HC&C system performance data in the future during remedial design.

The Gasco Consent Order clearly states that "cleanup alternatives shall be evaluated in the context of upland groundwater source controls, which will be implemented by this time, including [] reviewing groundwater seepage rate reductions as measured or predicted for upland source control performance[; a]pply the most up to date estimates of groundwater seepage rates and chemical concentrations (as measured or extrapolated) for evaluation of attenuation (i.e, MNR), capping, and dredging alternatives and their long term effectiveness[; and e]valuating attenuation rate predictions for groundwater and TZW that will not be directly remediated by upland source controls." EPA's unexplained retreat from a site-specific, technically sound decision framework that directly accounts for the performance of upland source controls to a generic approach that ignores established fact is arbitrary and inconsistent with the Gasco Consent Order. NW Natural respectfully requests that EPA state that technology assignments can be reevaluated during design in a manner that includes comparative effectiveness using site specific data and procedures consistent with the Gasco Consent Order (as was done in the Gasco EE/CA), including current conditions associated with existing upland groundwater source controls.

EPA Position:

As described in Section 3 of the 2016 FS, technology assignments were made based on environmental and anthropogenic conditions at the Site. The entire Portland Harbor Site (2,167 acres) exceeds PRGs and thus requires action. The four general response actions for consideration in the 2016 FS are capping, dredging, enhanced natural recovery (ENR), and monitored natural recovery (MNR) which is consistent with the technologies listed in the Gasco order. ENR and MNR (per EPA's 2005 Contaminated Sediment guidance) are most appropriately applied to low contaminant concentrations in large diffuse areas since:

- harm to the ecological community due to sediment disturbance may outweigh the risk reduction of an active cleanup
- slow in reducing risks in comparison to active remedies
- includes some risk of reexposure of the contaminants
- the time frame for natural recovery may be slower than that predicted for dredging or in-situ capping
- relies upon institutional controls, such as fish consumption advisories, to control human exposure during the recovery period, which may have limited effectiveness

Therefore, ENR and MNR were assigned to areas not addressed through capping and dredging since the Site will naturally recover once the higher concentration areas are addressed. The 2016 FS did not assign ENR in the main channel since the CSM is that this is a transitional river system where both deposition and erosion occur seasonally. Therefore, any sand placed in this area would be transported downriver and would not enhance the natural recovery in the area where it was placed. EPA identified Swan Island Lagoon as an area where ENR would be applied; however, there may be some opportunities in offshore areas (coves, embayments, slips) where ENR may be used to ensure PRGs are achieved, which can be explored in remedial design. These technology assignments are generally consistent with the LWG 2012 draft FS, although the LWG's 2012 draft FS assigned in-situ treatment within SMAs which EPA determined not be supported by the empirical evidence of the erosive conditions in many areas of the site (see EPA's comments 70 through 74 on the LWG's 2012 draft FS). **[AR Doc # 100007297 through 100007299]**

The navigation channel and future maintenance dredge areas were assigned dredging technology within sediment management areas (SMAs) since these areas are slated to be dredged in the future and therefore placement of a cap would prevent that activity (future dredging) in that area of the Site. This technology assignment is consistent with the LWG 2012 draft FS.

Caps were assigned under structures that would not be removed during remedial action. However, dredging with specialized equipment can be conducted under some types of structures. The decisions to remove a structure, dredge under a structure, or cap design will be made in remedial design.

In the shallow zone (which includes river banks), EPA applied a dredge/cap technology assignment within SMAs based on habitat issues and 404(b)(1) requirements. The amount of dredging and capping and the cap design used in this area is to be determined in remedial design. EPA made reasonable assumptions in the 2016 FS in order to develop a cost estimate.

The assignment of technologies within SMAs in the intermediate zone (the area between the navigation channel/FMD zone and the shallow zone) are discussed in Section 3.4.6 and Appendix C of the 2016 FS. Factors evaluated included current and reasonably anticipated future land and waterway use, areas of erosion/deposition, sediment bed slope, infrastructure such as docks and piers, and physical sediment characteristics. If both capping and dredging technologies were both found to work in a particular area of the Site, EPA applied the capping technology.

In-situ treatment was included as components of ENR, capping and dredge residual management in various areas of the river to address contaminated groundwater plumes and principal threat waste remaining in the river. Ex-situ treatment was also assumed as a component of disposing of certain dredge material. Several assumptions were made to develop costs in the FS regarding in-situ and ex-situ treatment of material for cost purposes, but the application and extent of treatment will be determined in remedial design.

Therefore, EPA did evaluate all available technologies to specific areas in development of the alternatives and selected the appropriate technology to use based on site-specific environmental and anthropogenic conditions. EPA's 2005 Contaminated Sediment guidance acknowledges that alternatives are combinations of technologies since single technologies do not work in a large complex river system with varied uses. [2016 FS, Section 3.1.1]

The decision trees in the 2016 FS merely presented these decisions and the assumptions used to develop the cost estimates and are not meant to imply prescriptive actions to be carried out in remedy implementation.

<u>TOC Holdings Dispute Issue 1</u>

The June 2016 FS neglects to include a discussion of upland source controls that have been implemented and the performance of those source controls in the remedial evaluations. The Time Oil groundwater plume identified in section 1.2.3.4 is fully controlled and meets JSCS values for all constituents other than potentially arsenic, which does not appear to be associated with site-related groundwater contamination.

EPA Position:
The purpose of the FS is to develop and evaluate remedial alternatives for the in-river portion of the Portland Harbor site. EPA is not making a cleanup decision on upland sources and therefore it was appropriate that the 2016 FS did not evaluate or discuss specifics about source control measures that have been taken. Prior to implementing the cleanup, the effectiveness of relevant source control actions will be evaluated to minimize the risk of recontamination. The 2016 FS assumed that all sources were controlled in evaluating and comparing the remedial alternatives' performance to each other. However, the 2016 FS acknowledges that there are some areas where the contamination (usually groundwater and subsurface sediment) extends beyond the point of upland control in which a reactive layer may be needed to ensure that PRGs will be attained in pore water. If PRGs are already attained, then a reactive layer will not be necessary. The 2016 FS identifies where known groundwater plumes throughout the Site are located and the contaminants of concern so that in remedial design focused pore water sampling can be conducted to determine the appropriate cap design or residual management layer to employ.

TOC Holdings Dispute Issue 2
EPA's application of E RALs in some but not all parts of SDU 3.5E results in the identification of a Sediment Management Area for PeCDD where the current SDU 3.5 SWAC already meets the most conservative PeCDD PRG of 0.0002 ppb for RAO2 (fish consumption on a river mile basis).71 Therefore, no sediment remedy is necessary to achieve RAO2 in the relevant exposure area.

EPA Position:
The RALs are applied to all parts of the Site and therefore all parts of SDU 3.5E. The RALs for an alternative are used in combination, not individually, to delineate areas to apply the remedial technologies of capping and dredging. If a contaminant concentration for one of the RALs is not exceeded in a particular part of the river, then that RAL is not applied. RALs are applied on a point-by-point basis, but evaluations of the effectiveness of the RAL achieving PRGs is conducted on broader spatial scales consistent with the baseline risk assessments. The evaluation is made on all contaminants posing risk, not individually.

Respondent is correct that the most conservative sediment PRG for 1,2,3,7,8-PeCDD is 0.0002 μg/kg for RAO 2. In review of Figure 3.4-10, which presents the 1,2,3,7,8-PeCDD RAL contours, the same RAL is used for Alternatives D, E, F and G of 0.0008 μg/kg, which is only a factor of 4 greater than the PRG. The pre-remedial SWAC in SDU 3.5E for 1,2,3,7,8-PeCDD is 0.00025 μg/kg (Alternative A) and the post remedial SWAC for Alternative E is 0.000048 μg/kg (see Table J2.3-7). Since the pre-remedial SWAC is greater than the PRG, a sediment remedy is necessary to achieve RAO 2 in the relevant exposure area. Further, the evaluation in the 2016 FS is based on a limited number of samples (19 sample locations) and additional sampling would need to be conducted to determine the extent of the contamination. A decision in remedial design based on additional sampling will have to be made as to whether or not the area warrants action.

UPRR Dispute Issue
The FS preferred alternative identifies two areas of sediments between RM 10 and 11 that EPA has identified for cleanup, purportedly due to exceedances of the PCB remedial action level ("RAL"). EPA also identified these areas on Figure 3.2-3 as containing principal threat waste. This area of the Site is near Union Pacific's railyard at Albina Yard. Union Pacific disputes this

determination, particularly the area from approximately RM 10.7 to RM 11 where there are no exceedances of the applicable RAL in surface or subsurface samples of sediments.

EPA's potential cleanup area near RM 10.7 appears to be based on a PCB exceedance in soil at one location on a 900-foot stretch of the riverbank. EPA included riverbanks as part of its draft FS evaluation of alternatives, but did not identify Albina Yard as a site with "known contaminated riverbank" in section 1.2.3.5 of the FS.

Moreover, in its Final Remedial Investigation/Source Control Measures Evaluation Report for Albina Yard dated November 2010, which was reviewed and approved by Oregon DEQ, Union Pacific determined that the riverbank near Albina Yard had a low potential for erosion because it was highly vegetated and stabilized with rock/rip rap. Because PCB concentrations in the sediments are below the applicable RAL, and the riverbank is stable, this area of sediments should not be included as a potential cleanup area. Certainly, the FS contains no explanation for this area's inclusion as a potential cleanup area, much less as an area containing principal threat waste.

EPA Position:
See EPA's position to UPRR's dispute issue 6.

III. LSS, Inc. (on behalf of Arkema, Inc.) DISPUTE STATEMENT RESPONSE

LSS Dispute Issue 1 - Inadequate Conceptual Site Model

EPA's inadequate conceptual site model (CSM) does not provide an adequate foundation for a thoughtful comparative evaluation of alternatives. The FS does not sufficiently describe the relevant site features, baseline risks, sources, chemical fate and transport, site uses, and other important factors necessary to understand the potential cost effectiveness of EPA's remedial alternatives. Information on contaminant fate and transport is not provided in EPA's CSM discussion. In addition, the site has been characterized by EPA based on aggregated sediment data (i.e., sediment data collected over more than a decade) without regard to time-dependent changes operating in this system. It is not possible to effectively evaluate remedial alternatives without a robust CSM of the site.

Some examples of specific technical issues with the CSM presented in EPA's FS report include the following:

Aggregating sediment data from the late 1990s through 2007 for the purpose of performing a sediment surface characterization. This is a fatal flaw in EPA's analysis as it prevents any signal of dynamic conditions from being observed; this is also an essential component of monitored natural recovery (MNR) that EPA has included as an important element of every alternative.

EPA Position:

See EPA's position to LWG's dispute issue 1d and 2a.

Assuming without evidence, and ignoring subsequent evidence to the contrary (including 2012 fish tissue, 2013 sediment profile imaging [SPI] data and 2014 sediment data) that the sediment surface conditions at this site are at steady state. The Portland Harbor site is clearly a dynamic system. This is a fatal flaw in the CSM.

EPA Position:

The CSM in the RI Report produced by the LWG and approved by EPA describes the lower Willamette River as a dynamic river system (see Portland Harbor RI, Sections 3 and 10). EPA's assumption was that the Site is in dynamic equilibrium, not steady state. EPA did consider the 2012 fish tissue data as a line of evidence for MNR (see 2016 FS Section 3.6.1.3). EPA only considered data collected under EPA approved work plans; the 2013 sediment profile imaging [SPI] data and 2014 sediment data were not collected under an EPA approved work plan.

Ignoring subsurface conditions where geochemistry and microbiology are key parameters associated with the natural recovery of several constituents for which EPA deems remediation a requirement. We know many areas of this site are under reducing conditions based on the presence of methane in cores. Reductive dehalogenation is a known pathway for natural recovery for some chlorinated compounds. In situ processes of natural recovery should have been addressed in the CSM and the FS. This is particularly important as a consideration for active remediation areas determined by EPA to be located landward of the pier-head line at the Portland Harbor site.

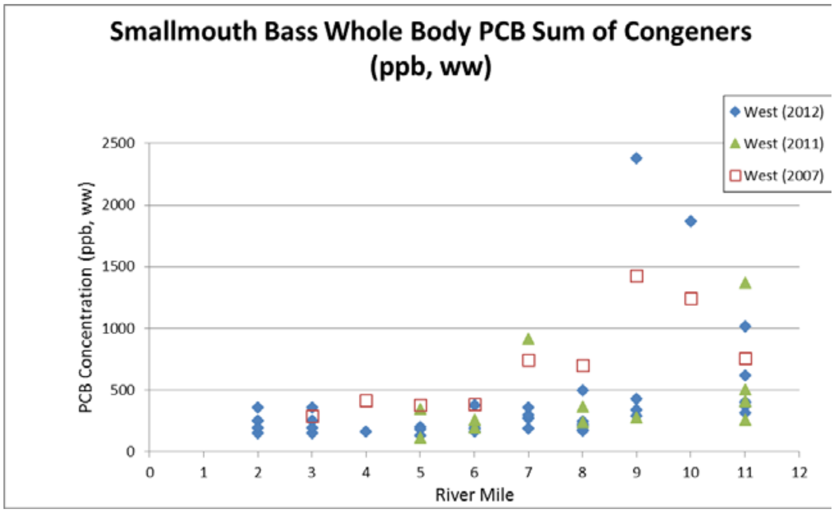
EPA Position:
EPA used the data collected by the LWG to draft the 2016 FS. The LWG did not evaluate groundwater plumes at the Site. As stated in the 2016 FS, the extent of groundwater plumes discharging to the river is currently unknown. Further, the effects of source control on groundwater plumes is unknown because EPA has not been provided any performance data. Information regarding the extent and degredation of groundwater plumes in the river will be considered in remedial design to ensure that adequate caps are placed in the river to deal with residual groundwater plumes, where necessary.

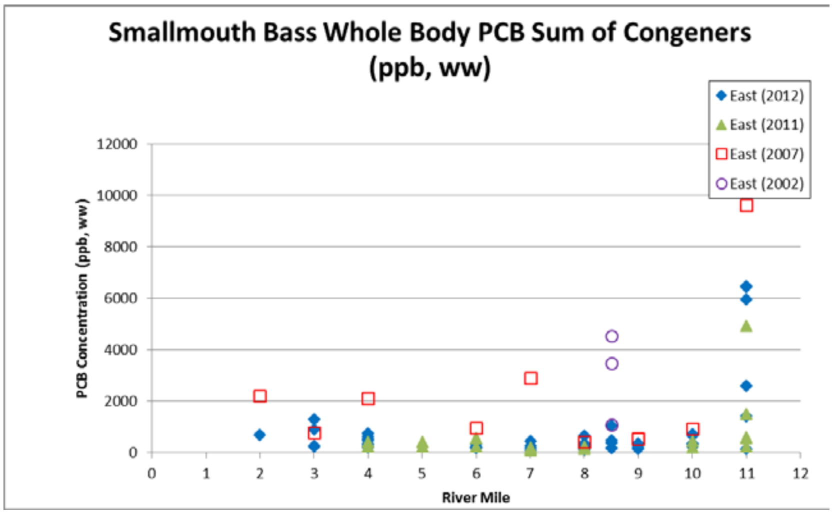
It is unclear if the sitewide total PCB spatially weighted average concentration (SWAC) values presented in EPA's FS included the RM 11.2 information acquired during the Supplemental RI performed in Segment 1 (River miles 9 to 11.7). This creates a significant problem in the comparison of subsequent surface SWACs because it suggests site conditions at the time of the RI were actually cleaner than they were. This makes the demonstration of significant sitewide natural recovery more difficult and inaccurate.

EPA Position:
The 2016 FS clearly states in Section 1.3 that the data collected by the RM 11E Group were not included in the FS database. EPA reviewed the data prior to making the decision not to include in the database (although it is in the administrative record because EPA considered it) and determined that it would not significantly change the remedial footprints. EPA is unclear why the Respondent believes that the omission of this data would result in a significantly different SWAC since the data were collected to supplement the RI/FS data, not to recharacterize this area of the Site. EPA did not look at natural recovery Site-wide as the river dynamics are not consistent throughout the Site. EPA looked at natural recovery on a smaller spatial scale as discussed in Appendix D8 of the 2016 FS.

The use of highly uncertain SWAC values (in some cases the SWAC values varied by an order of magnitude) in localized segments of the site to establish predicted tissue concentrations. This indicates a significant scale effect associated with the surface data used to support the CSM that indicate a lack of characterization in "extent" in the near field of EPA's CSM.

EPA Position:
The variation in the SWAC values in localized segments of the Site does not mean that the SWAC values are highly uncertain. It has to do with the variability in the sediment data and translates into the variability in the fish data. The smallmouth bass data collected in 2007, 2011 and 2012 all show that fish concentrations vary throughout the Site, as can be seen by the plots of the data in the following two figures.





Evaluating the SWACs on this spatial scale (1 RM) reflects the home range of the fish; thus, accurately predicts the exposure to the fish species from contamination in those areas of the Site, and are more representative of the effects of the cleanup in those areas.

A flawed approach was used for calculating site background concentrations (see dispute issue 11 below).

EPA Position:

See EPA's position to LSS's dispute issue 11, below.

A robust surface sediment data set that is representative of current conditions is critical for setting up initial conditions for the alternatives evaluated in the FS. EPA's FS uses aggregated sediment data from 1997 through 2007 for the surface sediment characterization. When these outdated data are used to define surface sediment concentrations at the site, it shifts the "knee of the curve" for comparing alternatives away from the alternatives with less active remediation (B, C, and D) and toward alternatives with more active remediation (E, F, G, and I). Graphs of PCB sitewide SWAC versus duration for EPA's FS SWAC (84 µg/kg) and the SWAC based on the *recent 2014 sediment data (40 µg/kg) are presented in Exhibit 1. CSM errors and omissions need to be corrected to properly understand the source, distribution, fate, and transport of site COCs and to accurately assess and weigh the differences between remedial alternatives.*

EPA Position:

EPA used a robust data set provided by the LWG under EPA oversight to develop the alternatives in the 2016 FS. The data set includes 2,293 surface sediment samples collected during the RI to characterize the baseline of the Site. The 2014 data set was not collected under an EPA approved work plan and the validity of the data is uncertain. Further, the 2014 data set is based on merely 98 samples, which is not comparable to the FS data set and can be misleading. [See pages 6 and 7 in **AR Doc ID # 100033508**.] As can be seen from these figures, the data collected in 2014 does not represent the distribution of contamination in the Site and development of RAL curves using that data apportion low level concentrations to large areas of the Site that are have greater concentrations. EPA does not believe there are any errors or omissions in the CSM and that the information used in the 2016 FS is sufficient to develop and select a remedial alternative. EPA acknowledges that additional baseline sampling will be needed during remedial design to implement the remedy and apply the decision tree.

LSS Dispute Issue 2 - Principal Threat Waste Adjacent to the Arkema Site

EPA inappropriately identifies chemicals in sediment adjacent to the Arkema Site as PTW based on either a "source material," "not reliable contained," or "highly toxic criterion. As expanded upon below, source material has never been identified in Arkema Site sediment; EPA should not identify chemicals that can be reliably contained as PTW; and chemicals that require long-term exposure durations through indirect exposoure pathways (i.e., consumption of fish tissue) should not be identified as "highly toxic." In addition, the blanket identification of large areas with low concentrations of chemicals in sediments as PTW is neither required by the National Contingency Plan (NCP) nor necessary to protect public health or the environment.

EPA errs when it misidentifies source material in the FS based on "globules or blebs of product in surface and subsurface sediments…." and when it states "NAPL observed in sediment cores offshore of Arkema contains chlorobenzene and DDT (dissolved)." Arkema/LSS disputes the presence of NAPL globules and blebs related to the site or historical site operations (i.e., sheens related to oils and other uses of the river by ships and other vessels are not related to Arkema and would not contain Arkema contaminants such as MCB). Arkema/LSS responded to CDM Smith's 2013 memorandum (Exhibit 2) that purports to identify NAPL at the Arkema site. To resolve the issue, Arkema prepared a work plan in response to EPA requests under the EE/CA Administrative Order on Consent (AOC) to yet again confirm that NAPL was not present in sediment adjacent to the Arkema site (Integral 2016, Exhibit 3). In addition, no samples of NAPL offshore of Arkema have identified an MCB NAPL. There is no data that supports EPA's statement that NAPL observed in Arkema sediment "…contains chlorobenzene….". Significantly, a document titled "Top 10 State Issues for Proposed Plan" obtained from the LWG's Freedom of Information Act (FOIA) request identified that based on Oregon DEQ's review of the data "The multiple phases of sediment investigation have not encountered sediment exhibiting NAPL saturated conditions that would warrant thermal treatment prior to management." The status column for the same issue states that "EPA agreed to not assume NAPL at Arkema for the purposes of the cost estimate" (Exhibit 4). Based on these records, we *conclude that EPA and DEQ agreed that there was no MCB NAPL in offshore sediments, and therefore the assertion that such sediments represent PTW Source Material as defined by EPA's PTW fact sheet is without foundation, acceptance, or support.*

EPA erred when it identified an extensive area of groundwater containing MCB DNAPL discharging to the river as "not reliable contained" (Exhibit 5). First, there is no documented MCB DNAPL groundwater plume to the extent shown in EPA's Figure 3.2-4, adjacent to the Arkema site. The nature and extent of MCB DNAPL in groundwater or sediment porewater as shown in this figure is not based on any current site data. Second, groundwater SCMs have been implemented at the site beginning in 2012, including an upland groundwater barrier wall and extraction and treatment system. The groundwater pathway to the river from upland areas that have MCB in groundwater has been cut off and continment has been in existence for 4 years, and therefore, there is no ongoing source of dissolved phase MCB to the sediment adjacent to the Arkema site. There is no scientific evidence that supports the existence of an ongoing source of MCB DNAPL to the sediment adjacent to the Arkema Site. Groundwater and porewater sampling conducted after the implementation of the SCM has not identified a MCB DNAPL source to sediment adjacent to the Arkema Site. The site characterization error which postulates an extensive area of chlorobenzene DNAPL in sediment at the Arkema Site biases the assessment and comparison of the effectiveness of alternatives as evidenced from the following text: "Alternative D has less capped area (71 acres), but does not reliably contain all PTW remaining in the river." (USEPA 2016, p. ES-15). Without an accurate assessment of NAPL, PTW and PTW areas, EPA's alternatives evaluation is highly inaccurate.

EPA errs when it misidentifies the remaining areas of the Arkema site (including areas upstream and downstream of Arkema; Exhibit 5) as containing "highly toxic" PTW based on surface sediment concentrations for DDx, 2,3,7,8-TCDD, 2,3,7,8-TCDF, 1,2,3,7,8-PeCDD, 2,3,4,7,8-PeCDF, and 1,2,3,4,6,7,8-HxCDF that exceed a 10-3 excess cancer risk level for fish consumption based on the fish ingestion risks from the baseline human health risk assessment (BHHRA). This definition of highly toxic based on a long-term (30 year) exposure to a chemical substance via a fish consumption pathway is not the intent of EPA's PTW fact sheet. These 10-3 risk levels include long-term exposure parameters and indirect exposure based on a 30-year subsistence fish consumption scenario, which does not meet the definition of highly toxic (i.e., toxic under a direct contact or acute exposure scenario). Highly toxic levels should be based on direct exposure conditions only. Furthermore, the 10-3 excess cancer risk is only a suggested basis and is not prescriptive.

The EPA's proposed highly toxic PTW levels should also be considered in a broader context. EPA's highly toxic PTW values for some constituents are well below cleanup levels and screening level for unrestricted use established for other sites and scenarios. For example, the PCB PTW value of 200 µg/kg is below cleanup goals for many other CERCLA sites, which are at or above 200 µg/kg, typically in the 1,000 µg/kg range. The EPA regional screening level (RSL) for residential soil in fact is 249 µg/kg; in other words, soil with PTW levels specified in the FS could be used as clean fill at homes, schools, and day care facilities. In this context it does not make sound technical or risk management sense for the PTW level to be set at 200 µg/kg. An approach more consistent with the intent of EPA's PTW guidance would be to set the PTW level at a 10-3 risk value based on direct contact to sediment (removal action objective 1 [RAO1]);

that would be the lower of the 10-3 risk level (370,000 µg/kg), the hazard quotient (HQ) of 10 (147,600 µg/kg) (as stated in the guidance), or for the PCB case, the TSCA waste threshold (50,000 µg/kg). The use of the TSCA threshold for PCBs is also consistent with decisions at other CERCLA sites. A similar approach should be taken for the other constituents for which highly toxic PTW has been identified, especially dioxins/furans for which the PTW level in the FS is less than 3 times the EPA-recommended preliminary remediation goals PRG for dioxins/furans (once toxicity equivalence factors (TEFs) are applied). LSS belives that application of the revised and readily accepted PTW standards for not reliable contained or highly toxic material will result in none of the sediment at the Arkema site being identified as PTW.

EPA Position:

LSS makes two main points on this issue: (1) "EPA should not identify. . . chemicals that require long-term exposure durations through indirect exposure pathways (i.e., consumption of fish tissue) . . . as "highly toxic" and (2) that there is no NAPL in the river adjacent to its facility. On the first point, LSS provides no statutory or regulatory support for its position of what can or cannot be principal threat waste.

The NCP [40 CFR 300.430(a)(1)(iii)] states:

> (iii) Expectations. EPA generally shall consider the following expectations in developing appropriate remedial alternatives:
>
> (A) EPA expects to use treatment to address the principal threats posed by a site, wherever practicable. Principal threats for which treatment is most likely to be appropriate include liquids, areas contaminated with high concentrations of toxic compounds, and highly mobile materials…

The NCP does not say that principal threats at a site can't relate to contaminants posing a bioaccumulative risk. Identification of principal threats is a site-specific determination. EPA's *A Guide to Principal Threat and Low Level Threat Wastes* (1991) indicates that the NCP principal threat expectation reflects the belief that certain source materials should be treated given the long-term unreliability to contain them or the serious consequences of exposure if a release were to occur. Source material is defined as material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to ground water, to **surface water,** to air, or acts as a source for direct exposure. (emphasis added) Identifying principal and low-level threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner and/or would present a significant risk to human health or the environment should exposure occur. Conversely, low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied. EPA agrees that the NCP does not mandate a classification of wastes at a site.

However, EPA disagrees that the entire Portland Harbor site represents large areas with low concentrations of chemicals in sediments. The presence of liquid wastes such as NAPL, mobile source materials that are not readily contained, and contaminants that are highly toxic to sensitive populations are strong indicators of wastes that would be consistent with EPA's *A Guide to Principal Threat and Low Level Threat Wastes* as being identified as PTW. Likewise, the setting of the release of hazardous substances and the exposures that are likely to occur at a particular site is relevant to identifying principal threats. LSS's claims that the PCB PTW levels could be used as fill in a residential setting is totally irrelevant to this FS, which was analyzing cleanup alternatives for addressing contaminated sediment and surface water to protect the in-river receptors. Significant risks to wildlife and people, particularly, infants and children who eat or whose mothers eat resident fish from the site has been documented. Stating where the contaminated sediment could go or be placed and not be presenting a risk is irrelevant to the issue of what is principal threat waste in the lower Willamette River.

The identification of PTW at the Portland Harbor site is consistent with the NCP and EPA guidance. EPA's *A Guide to Principal Threat and Low Level Threat Wastes* further clarifies that principal threat wastes are "those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur." The guidance goes on to state that "no 'threshold level' of toxicity/risk has been established to equate to 'principal threat.' However, where toxicity and mobility of source material combine to pose a potential risk of 10^{-3} or greater, generally treatment alternatives should be evaluated." EPA's guidance does not distinguish between risks due to indirect exposure associated with fish consumption and direct contact exposure. As a result, EPA's definition of highly toxic PTW is considered consistent with the NCP and EPA guidance.

TSCA is not a factor for PTW identification. LSS indicates that the use of the TSCA threshold for PCBs is consistent with decisions at other CERCLA sites; however, the sites are not identified in the comment, and therefore, it is not clear whether the use of TSCA at the referenced "other CERCLA sites" was for identification of PTW or for other purposes such as a cleanup level or offsite disposal requirements.

EPA's *A Guide to Principal Threat and Low Level Threat Wastes* states that "no 'threshold level' of toxicity/risk has been established to equate to 'principal threat.' The classification threshold value for PTW is based on site-specific circumstances. Consistent with the NCP and EPA's PTW guidance and site-specific conditions, PTW has been identified based on a 10^{-3} cancer risk (highly toxic) or NAPL within the sediment bed (source material) and on an evaluation of mobility of contaminants in the sediment.

LSS's second point is whether NAPL exists at its facility. EPA disagrees with LSS' assertion there is no evidence PTW as defined by EPA's PTW fact sheet exists adjacent to its facility is without foundation, acceptance, or support. As noted in the comment, EPA has identified the presence of NAPL offshore of the Arkema site based on physical observations and other information indicating the presence of NAPL. Chlorobenzene is used in the DDT manufacturing process and the largest amount of chlorobenzene DNAPL is present under and around the manufacturing process residue (MPR) pond in the Acid Plant Area. This indicates that liquid chlorobenzene may have been discharged directly to the MPR pond along with other process residues. DDT is produced by combining chlorobenzene with trichloroacetaldehyde and an excess of chlorobenzene is essential to the reaction, which leads to considerable amounts of unreacted chlorobenzene being generated as a by-product with the DDT (Curtin, 1953). This means it is likely that large amounts of chlorobenzene were being discharged as liquid waste, a hypothesis that is supported by the information in the 2005 RI Report. The horizontal and vertical extent of chlorobenzene NAPL within the upland is also well documented in the 2005 RI report. Sediments and groundwater in the vicinity of Docks 1 and 2 have also been affected by the migration of the NAPL plume at the upland MPR pond and have high dissolved concentrations of chlorobenzene. Six sediment cores were indicative of the presence of NAPL based on field screening but none of these were conclusively identified as chlorobenzene NAPL. **[AR Doc # 686965]**

Qualitatively, soils with chlorobenzene concentrations greater than 10,000 mg/kg would indicate the presence of NAPL, however NAPL may also be present at lower concentrations (Feenstra et al. 1991). The highest chlorobenzene soil concentration identified in the Arkema RI is 43,000 mg/kg so the presence of chlorobenzene NAPL can be expected. Typically, dissolved concentrations greater than 1 percent of the aqueous solubility limit are suggestive of NAPL presence; however, concentrations less than 1 percent are not necessarily indicative of NAPL absence (Cohen et al. 1992; USEPA 1992a,b). The maximum in-water groundwater concentration and sediment porewater/transition zone water (TZW) concentration of chlorobenzene measured in the vicinity of Docks 1 and 2 is 64 mg/L and 30 mg/L, respectively. Both TZW and in-water groundwater concentrations are greater than 1 percent of chlorobenzene’s solubility of 500 mg/L (i.e., greater than 5 mg/L). The results do not show extensive visual evidence of chlorobenzene NAPL present in groundwater and sediment porewater; however, the dissolved chlorobenzene concentrations are deemed indicative of the presence of residual chlorobenzene NAPL in the vicinity of Docks 1 and 2 (CDM Smith 2013).

Core logs from sediment borings installed offshore of the Arkema site were evaluated to determine whether visual observations of blebs, globules, dark brown oily material, or other terms indicating presence of product were present. Other lines of evidence evaluated included sheens and odors along with corresponding elevated organic vapor meter (OVM) readings, transition zone water (TZW) and offshore groundwater concentrations at levels exceeding 1% of solubility, and the documented presence of dense non-aqueous phase liquid (DNAPL) in upland soils. These lines of evidence clearly indicate that NAPL may be present offshore of the Arkema site.

EPA acknowledges statements by ODEQ that multiple phases of sediment investigation have not encountered sediment exhibiting NAPL saturated conditions that would warrant thermal treatment prior to management and that the most significant observations have been the occasional sheen and product bleb. However, ODEQ also notes that it is possible that RD/RA activities could encounter a pocket of heavily NAPL impacted sediment and recommends that EPA adaptively manage these potential circumstances rather than ascribe a large treatment cost associated with these sediments to the Portland Harbor remedy. **[AR Doc ID # 100019939]** To estimate the potential treatment costs that may be associated with mobile PTW offshore of the Arkema facility in the 2016 FS, EPA applied no treatment to one-third of this material, solidification/stabilization to one-third of this material, and thermal treatment to one-third of this material. EPA has not made any decisions or requirements for treatment of this material at this time; this decision will be made in remedial design phase of the project.

Based on existing information, the 2016 FS assumes some pesticide/chlorobenzene PTW wastes will need to be dredged and disposed of off-site at the Area 7W SDU; however, it also assumes that not all contaminated sediment generated during dredging or capped in situ at the Area 7W SDU will require treatment. Remedial design sampling will need to further refine the waste characterization along with the identification of PTW at this area of the site; final dredge and capping footprints; and what treatment for off-site disposal may be required.

The EPA disagrees with the statement that it erred in identifying an extensive area of groundwater containing MCB DNAPL discharging to the river as “not reliable (sic) contained” (Exhibit 5). First, the figure referenced in Exhibit 5 does not show, nor intends to show a groundwater plume. The figure referred to in the comment, Figure 3.2-4 in the 2016 FS, presents an FS level understanding of the extent of contaminants within the river. This extent is based on limited remedial investigation sampling that bounds contaminant concentrations meeting PTW thresholds. The EPA anticipates additional, more extensive site data will be collected during the remedial design phase to refine this FS level characterization. Second, the assertion made in this comment that SCMs have “cut off” and contained the groundwater pathway to the river from upland areas that have, or could potentially have MCB in groundwater, is not supported by any data, or information provided in the comment. Without this information, the comment assertions are speculative.

The EPA’s current understanding of the groundwater extraction and treatment system referenced in the comment is that there have been performance issues with the treatment system and biofouling of the extraction wells to the point that a Corrective Action Plan has been submitted at DEQ’s request (ERM West, Inc., 2016) providing a path forward to bring the system into compliance to meet its operational capture and treatment objectives so that DEQ and EPA can complete their evaluation of the operations effectiveness in cutting off and containing any potential ongoing source of dissolved phase contaminants discharging to the in-river sediment adjacent to the Arkema site. Further, the comment implies EPA’s alternatives evaluation is highly inaccurate without an accurate assessment of NAPL, PTW and PTW areas and quotes a sentence out of the 2016 FS Executive Summary to prove its point. EPA contends that appropriate FS level alternative assessment information is found within the body of the document and not exclusive to text within the Executive Summary. That said, it is unclear what specifically is inaccurate about the summary statement pulled from the executive summary. The 2016 FS presents an assessment of the extent of NAPL, PTW and PTW areas based on the RI data. Using this information and honoring the context of the Executive Summary statement, there is nothing inaccurate in the statement that “Alternative D has less capped area (71 acres), but does not reliably contain all PTW remaining in the river”.

LSS Dispute Issue 3 - Inappropriate waste designation for sediments adjacent to the Arkema site

The assumed areas for disposal of sediment as RCRA waste (Figure 3.4-35, Exhibit 6) are based on a single toxicity characteristic leaching procedure (TCLP) sample for lead1 and no TCLP *samples for chromium. Based on sediment analytical results, the area shown on Figure 3.4-35 does not represent sediment that will require RCRA Subtitle C landfill disposal. The State-listed pesticide residue designation also does not necessarily apply to sediment at the Arkema Site (Figure 3.4-36, Exhibit 6). As recently as February 2016 DEQ was researching the issue of whether sediment near Arkema would be designated a State-listed pesticide waste. Item 3 of the "Top 10 State Issues for Proposed Plan" document obtained from the LWG's FOIA request (Exhibit 4) states that "Sean needs State determination of State-only pesticide question, which Matt is researching." However, even if it is determined that some portion of the sediment is a State-listed pesticide residue waste, it would not preclude the placement of this sediment in a CDF (see HWIR discussion below) or disposal in a Subtitle D landfill out of state. When a State-listed hazardous waste is transported out of state (i.e., the Roosevelt Regional landfill presented in the FS), the Oregon State waste designation no longer applies, and the waste can be disposed as a non-hazardous waste so long as it meets other landfill disposal criteria. This waste disposal process was recently demonstrated by the disposal of soil from the Arkema Stormwater and Groundwater SCMs, which was disposed of at Roosevelt landfill in Washington.*

1 The analytical results minimally exceeded TCLP regulatory limits for lead in this sample. LSS notes that the TCLP samples were collected from specific intervals from single boreholes and were not necessarily representative of the general area around these boreholes. As perhaps a more appropriate approximation representative of bulk sediments, drummed sediments that contained the referenced sample intervals were re-sampled and analyzed for TCLP to evaluate the disposal options for these sediments, and none of those re-sampled drums exceeded the TCLP concentrations.

EPA Position:
EPA made assumptions in the 2016 FS regarding waste disposal to develop a cost estimate. The State did not provide EPA with any definitive information on state listed waste designation, therefore, EPA did not assume that all waste removed offshore of the Arkema would be required to go to a Subtitle C landfill, only the portion that was identified as NAPL-NRC. As EPA clearly states in the 2016 FS, the ultimate disposal requirements will be set by the disposal facility after adequate characterization is accomplished and a disposal facility identified.

Arkema disagrees with the cost assumption that "cement solidification/stabilization, low temperature thermal desorption, and no treatment will be used in equal proportions to treat pesticide/chlorobenzene PTW" for the disposal of dredged sediment that meets EPA's PTW criteria from the Arkema site. Not withstanding the fact that there are no PTW sediments currently identified off the Arkema Site, the FS fails to clearly outline the basis for EPA's assumptions regarding treatment as a prerequisite for offsite disposal. Section 3.2.2.3 makes vague references to regulatory "standards" and "requirements;" however, it fails to clearly identify specific regulations and the conditions under which they are assumed to apply, or not apply, to sediments that are designated as PTW and the mechanism under which they derive need for treatment prior to offsite disposal. Furthermore, the "Top 10 State Issues for Proposed Plan" document obtained from the LWG's FOIA request (Exhibit 4) states that "DEQ wants to be clear that land disposal of these sediments does not require treatment under Oregon Administrative Rules." As presented, EPA has arbitrarily made more conservative assumptions for disposal of PTW defined by sediments containing DDx and NAPL than it has for PCBs, *dioxin/furans, and PAHs. LSS believes that based on current data, none of the sediment at the Arkema site should be classified or handled as a Federal- or State-listed hazardous waste.*

<u>EPA Position:</u>
PTW has a statutory preference for treatment. EPA expects to use "treatment to address the principal threats posed by a site, whenever practicable" and "engineering controls, such as containment, for waste that poses a relatively low long-term threat." [40 CFR Section 300.430(a)(1)(iii).] EPA identified potential PTW offshore of the Arkema Site (see Figure 3.2-4). Since it is currently unknown what, if any, treatment requirements will be necessary for disposal of removed waste offshore of the Arkema facility, EPA used a range of options to base the 2016 FS costs. The actual costs and requirements will not be determined until remedial design or after removal and characterization of the waste and identification of the actual disposal facility.

<u>LSS Dispute Issue 4 - Inappropriate Application of the Hazardous Waste Identification Requirements (HWIR) Rule for Disposal of Sediment in a CDF</u>
EPA's FS asserts that Dredged material subject to requirements of a permit that has been issued under Section 404 of the CWA is excluded from the definition of hazardous waste (40 CFR 261.4(g)). This provision is discussed in the Hazardous Waste Identification Rule (HWIR) (63 Federal Register [FR] 65874, 65921; November 30, 1998). Oregon State adopted the HWIR rule in 2003. This rule means that RCRA regulatory requirements do not apply to sediment dredged at the Site and disposed of on-site, such as at the Terminal 4 CDF, if the material otherwise meets the CDF acceptance criteria. (emphasis added)

EPA has correctly stated that RCRA regulatory requirements, including the designation of waste sediment as either a Federal or State-only hazardous waste, do not apply to sediment placed in a CDF; however, the statement mischaracterizes the CWA requirement that the sediment must meet CDF acceptance criteria for this rule to apply. This is simply not the case. Because DEQ has adopted the federal HWIR-media rule, and the CDF would meet CWA Section 404 requirements, RCRA Subtitle C requirements would not apply, and the dredged material placed in the CDF would not be a hazardous waste. The disposal of Arkema sediment in a Terminal 4 CDF should, therefore, be considered. The failure to consider CDF disposal for Arkema dredged sediment artificially inflates the disposal costs for alternatives related to the dredging at the Arkema site. In conclusion, EPA disregards the scope and intent of the HWIR Rule by placing arbitrary restrictions on what EPA believes can be placed into the T4 CDF if constructed. All of the EPA's Acceptance Criteria for the T4 are arbitrary and should be removed. Disposal of dredged material should follow the HWIR Rule as adopted by the State. This arbitrary action by EPA have severe negative implications for the FS and any subsequent RA.

EPA Position:
EPA sited CDF acceptance criteria in the 2016 FS, Section 3.4.9.2. There are no statements in the 2016 FS that identify a CWA requirement that the sediment must meet CDF acceptance criteria. EPA developed the CDF acceptance criteria based on protectiveness.

LSS Dispute Issue 5 - Feasibility study sediment and fish tissue dataset is not representative of current site conditions
EPA's draft final FS is based on a data collected between 1997 and 2007 and is not representative of current conditions at the site. The 2014 surface sediment PCB data collected by Kleinfelder to provide a current reference for comparison of the Portland Harbor RI dataset was not discussed or evaluated in the FS. It is unclear if the recent sediment PCB data collected by the RM11E Group was included in EPA's FS. These data are critical to the FS because the RM11E area is a source of PCBs in the upstream portion of the site and has significant implications for assessing remedial alternatives, calculating SWACs, and assessing residual risk for the Portland Harbor site. PCBs are the primary risk driver for the Portland Harbor site and some of the most critical data for evaluating PCBs was omitted by EPA in the FS report.

A surface sediment and fish tissue dataset representing current conditions must be generated for the FS to accurately assess remedial alternatives. A new dataset will account for natural recovery that has occurred at the site since the Portland Harbor dataset was collected between 9 and 19 years ago and will fill a critical data gap in EPA's FS.

In Section 3.6.1.3, EPA's updated evaluation of fish tissue concentrations over time ignores 2002 data without any explanation. EPA states in this section a downward "trend" in fish tissue concentrations. In all but two instances (RMs 4E and 7E), concentration declines were not statistically distinguishable from zero. Possible explanations are the trend itself is close to zero, or the estimated coefficient could be very different from zero with a very wide confidence interval. The former would imply that the decay rate is small and that it is simply close to zero with strong level of confidence, whereas the latter indicates that the data are too sparse to precisely estimate the decay rate.

This section also states that the previous fish data are sufficient for baseline conditions for PCBs. This statement is incorrect since these data will be nearly 10 years old when the remedy is implemented and will not be representative of baseline conditions.

The Arkema pre-remedial design investigation work plan (Integral 2016) evaluated natural recovery at the Portland Harbor site (Exhibit 3, Appendix H). In this analysis, the original RI data sets were evaluated against more recently collected smallmouth bass fish tissue (2012), SPI (2013), and surface sediment PCB (2014) data. Based on a total of eight lines of evidence, including tests of statistical significance and a likelihood analysis, the weight of evidence strongly supports that natural recovery is occurring and will continue to occur within Portland Harbor. Therefore, MNR is a strongly viable process that should be utilized in Portland Harbor sediment remedies, including the area adjacent to the Arkema site. This analysis and its conclusions are directly relevant to EPA's alternatives analysis, comparison, and effectiveness evaluation, and therefore the lack of more recent data analysis biases the conclusions of EPA's alternative analysis and selection for sediment management areas (SMAs), including SMA 7W.

EPA should incorporate the complete existing fish tissue data sets, as was done in the Integral (2016) analysis, and also allow for an updated fish tissue collection study to determine the current baseline fish tissue concentrations of COCs and demine the current site risk.

EPA Position:

As described in Section 1.3 of the 2016 FS, the FS data set included data collected under EPA oversight through authority of the Portland Harbor, Gasco and Arkema AOCs. The data presented in the 2014 Kleinfelder report were not collected under an EPA-approved, work plan. As noted in EPA's position to LWG's dispute issue 1d, Respondents' 2012 draft FS notes that temporal changes in contaminant concentrations were not an objective of the data collection efforts, and that the aggregated data collected between 1997 and 2010 has been deemed representative of current conditions in the site. As clearly stated in Section 1.3 of the 2016 FS, sediment data collected by the RM11E Group were not included in the 2016 FS because upon review, the data was not significantly different than RI data. Thus, it should not be "unclear" whether these data were included. The PCB SWAC concentration for SDU RM11E represents one of the highest concentrations within the Site, and LSS provided no information why RM 11E data would alter the FS analysis of alternatives.

The 2016 FS uses sediment data collected as recently as recently 2013, and presents and discusses contaminant concentration trends in fish using data collected as recently as 2012. Thus, the assertion the data are a minimum of 9 years old appears deliberately misleading. As noted in Respondents' FS, the large data set is considered adequate to represent current conditions and is adequate for evaluating alternatives in the 2016 FS. Additional sampling to more fully assess "current conditions" is a remedial design issue and beyond the scope of the 2016 FS and dispute.

Tissue data for smallmouth bass collected in 2002 are not directly comparable with the data collected in 2007 and again in 2011/12. Individual fish collected in 2002 were composited by river mile without regard to side of the river prior to analysis. In 2007, fish were composited by river mile but segregated by side of the river prior to analysis, while fish collected in 2011/12 were analyzed individually. As discussed in the ODFW 2005 study cited in the risk assessments, radio tracking of smallmouth bass indicated that their home range is typically between 0.1 and 1.2 km, and they exhibited a strong preference to remain in near-shore habitat. Given the heterogeneous nature of the contaminant distribution within the site, contaminant trends in fish were evaluated by river mile and by side of river. Because of the compositing scheme used in 2002, meaningful comparisons of these data with subsequent tissue results are not possible.

The term "baseline conditions" here defines the conditions prior to initiating a response action. As such, since the existing data represent conditions prior to initiating a remedial response, they represent "baseline" conditions. EPA does agree that additional tissue sampling prior to implementing a remedy is appropriate, as the current data set is limited to a single species (smallmouth bass) and a single contaminant (PCBs). The exact nature and design of such a sampling effort is beyond the scope of the 2016 FS and dispute. With regard to the age of the data at remedy implementation, given that the most recent tissue data was collected in 2012, EPA is disappointed to learn that LSS has no intention of performing any work prior to at least 2022.

The Arkema pre-remedial design investigation work plan was disapproved by EPA on March 30, 2016 for the reasons provided in the disapproval letter. EPA concurs that natural recovery is occurring within most areas of the Site and that it should be utilized in the sediment remedies, as evidenced by the fact that MNR represents the response action assigned to between 64 and 90 percent of the total area of the Site for all alternatives carried through the detailed analysis in the June 2016 FS.

LSS Dispute Issue 6 - Inappropriate use of PCB non-detected values in RAL and PTW footprint maps

The RAL and PTW footprint maps incorporate data with high PCB detection limits adjacent to the Arkema site (Exhibit 7). The high PCB non-detects with detection limits 5 times EPA's PTW value (e.g., >1 mg/kg) occurred in the Aroclor analysis as a result of a matrix interference with DDx. The RAL and PTW footprint maps should only consider detected PCBs based on PCB congener concentrations adjacent to the Arkema site due to the well-known matrix interference with DDx in PCB Aroclor analyses. The identification of PTW and remediation footprints for PCBs adjacent to the Arkema site based on non-detect values with elevated detection limits resulting from matrix interference with DDx is inconsistent with EPA's PTW fact sheet guidance and biases the assessment of PTW and remediation footprints for the SDU RM7W alternatives. This exaggerated PCB footprint will also bias the alternative selection for SDU RM7W. EPA should remove the PCB non-detect value from this PCB footprint analysis as it biases and exaggerates the area of PCBs in sediment at the site. If necessary, additional PCB congener data could be collected from these high non-detect sample locations to confirm the absence of high concentrations of PCBs at these locations.

EPA Position:

EPA used the data provided by the LWG. The LWG did not indicate that there were any issues with this data nor did they remove this data from the database provided to EPA. If there were issues with this data, LWG should have flagged the data and resampled the Site using congener analysis. EPA agrees that congener, not Aroclor, data should be collected at this Site in remedial design. Review of the footprints for PCB RAL contours (Figure 3.4-7), DDx RAL contours (Figure 3.4-12), and dioxin/furan RAL contours (Figures 3.4-8, 3.4-9, and 3.4-10) indicates that the SMA footprint offshore of the Arkema property is largely driven by DDx and dioxins/furans and overlaps with the PCB RAL footprint; thus, omitting PCB data from this area would not substantially change the evaluation in the 2016 FS. New data will be collected in remedial design that will determine the SMA boundaries based on the final RALs selected in the ROD.

LSS Dispute Issue 7 - Inaccurate RAL and PTW footprint maps

The PCB and PCDD/F RAL and PTW maps were contoured using natural neighbors gridding and did not account for the flow direction or depositional environments in a river system. The RAL and PTW maps in EPA's FS report blindly used nearest neighbor interpolation, and data points were inappropriately interpolated through upland areas. An example of this inappropriate interpolation is between points in the Willbridge Terminal and the area between Dock 1 and the Salt Dock on the Arkema Site (Figures 3.4-7, Exhibit 7 and 3.4-11, Exhibit 8). In this example, *the points are not correlated and should not be interpolated through the upland portion of the Arkema site. The RAL and PTW maps must include some interpretation to reflect the physical features of the site and site uplands, as well as the hydrodynamics of a river system. This manual interpretation should be done for the PCB and PCDD/F maps covering the area adjacent to the Arkema site.*

EPA Position:

EPA acknowledges the limitations of natural neighbor interpolations. However, the primary limitation to natural neighbor interpolations is data density. Because the Willamette River is subject to frequent flow reversals, considering flow direction is not expected to improve the accuracy of natural neighbor interpolations. With respect to consideration of depositional environments, EPA's natural neighbor interpolation divided the Willamette River into three lateral zones – west nearshore, navigation channel and east nearshore which is considered the key geomorphic factor affecting flow dynamics within the lower Willamette River. EPA also acknowledges that some of the interpolations extended through upland areas. However, these instances are few and not expected to fundamentally alter depiction of the distribution of contamination at the site.

LSS Dispute Issue 8 - Inconsistent risk assessment methods and risk inequality for various compounds

Interim targets for risks and hazard indices (HIs), which were established by EPA in the FS "…to evaluate the potential for achievement of PRGs in a reasonable time frame" (Section 4.1.3) were not consistent between chemicals of concern (COCs) and RAOs. As such, estimated residual risks were not consistent among the COCs (e.g., total PCBs has 5x10-5 residual risk and DDx has 1x10-6 residual risk for RAO2 [Appendix J, Table J1-2]). This is mainly due to a very low and unattainable sediment PRG that was calculated using average fish tissue concentrations and ambient water quality criteria (AWQC) for surface water inputs to the food web model (FWM), which resulted in very low or even "0" value PRGs (issues related to the FWM are provided below in dispute issue 13). This then resulted in defaulting to background for several COCs. Remediation to background levels is not realistically achievable.

This FS also adopts entirely new methods to estimate pre- and post-construction risks for the alternatives (Appendix J). The residual risk evaluation process is neither technically sound nor transparent. There is no rationale or a clear example provided for the process. The FS states that methods used to evaluate residual risks are consistent with the Baseline Risk Assessments, but this is not an accurate characterization of these methods. Some examples of differences in risk assessment methods and assumptions include:

- *Fish meals/10 years was not used in the BHHRA and no rationale was provided in the FS for using this unit.*
- *Appendix J presents the RM/SDU residual risks using fish ingestion rate of 49 g/day, however, PRGs based that ingestion rate have not been selected in the FS.*

The difference in the risk assessment methods risks is apparent if the risks estimated for Alternative A (no action) are compared to baseline risks from the BHHRA—these should be the same.

The only spatial scale that allows for direct comparison of risks is at the sitewide scale. The sitewide fish consumption risks estimated in the BHHRA (summarized in Section 1.2.5.1) are higher than those presented for Alternative A in Table J2.3-1a. However, the risks for Alternative A are based on average concentrations whereas the BHHRA risks are based on 95% upper confidence limit (UCL) or maximum concentrations. The average PCB concentration in the BHHRA based on actual tissue data was 160 µg/kg in bass and 2,500 µg/kg in carp, which includes a single outlier sample of 19,000 µg/kg (the average without the outlier is 353 µg/kg). The modeled tissue concentrations used for Alternative A are 352 µg/kg for bass and 820 µg/kg for carp, which are approximately 2 times higher than the measured tissue concentrations (excluding the single carp outlier).

The river mile risks for Alternative A cannot be compared directly with the BHHRA because the risks for Alternative A are on a rolling river mile basis for both sides of the river and navigation channel whereas the BHHRA risks were for an entire river mile. The risks for Alternative A are generally higher than those in the BHHRA (potentially due to spatial scale issues). In the BHHRA, risks at RM 11 were 1x10-3 and all other risks were less than 1x10-3. For Alternative A, there are several segments with risks of 1x10-3 or higher.

There continues to be an issue with EPA's modeled dioxin/furan tissue concentrations. In the BHHRA, the sitewide risk from the total toxicity equivalent (TEQ) based on the 95% UCL or maximum concentration for actual tissue data was 2x10-4. For Alternative A, the sitewide risk from 1,2,3,4,7,8-HxCDF alone based on an average concentration is 6x10-4 (Table J2.3-1a of EPA's FS report). There is no way that the risk from an individual congener can be higher than the total TEQ.

Furthermore, the residual risk assessment appears to present relative risks and not absolute risks. The term "residual risk" is used in different ways throughout the document, but it appears that EPA first estimated risks associated with the selected PRG (in general a risk of 1x10-6 or an HQ of 1 where the PRG is risk-based, but some other value if the PRG is not risk-based). For example, for RAO2, the residual risk (which is a ratio of the selected tissue PRG to the risk-based tissue PRG) for DDx is 10-6 because the fish tissue PRG (3 parts per billion [ppb]) is equal to the risk-based tissue PRG (3 ppb). However, for PCBs, the risk-based fish tissue PRG is 0.5 ppb and yields a "0" sediment concentration, and the PCB sediment PRG, which is the background value of 9 ppb, is apparently used in the FWM to calculate a PCB fish tissue concentration of 23 ppb (Table J1-2 of the FS). The sitewide residual risk for PCBs was estimated to be 5x10-5 (i.e., 23 divided by 0.5 and multiplied by 10-6). Then the "post-construction risks" was calculated for each alternative using SWACs to estimate fish tissue concentrations, again using the FWM and ratio of this "post-construction risk" and the "residual risk" to understand the "magnitude of residual risk." Again, this is relative risk and not absolute risk. Therefore, the risks between COCs are not comparable as some are based on actual risks (where the selected PRG is risk-based) and some are relative risks (where the *selected PRG is not risk-based). This approach is not at all consistent with the methods of the BHHRA and BERA and also misleading.*

The post-construction sediment concentrations also appear unrealistic. For example, some of the PCB and DDx post-construction concentrations in Table J2.3 are below the background concentrations. Other tables in Appendix J show similar results. It is unclear how remedies will result in concentrations below background. In addition, the concentrations of COCs used in the remediated areas to calculate the post-remediation SWACs were 0, which does not account for dredge residuals or background (upstream) concentrations of COCs.

A significant deficiency of the residual risk evaluation is that it does not provide residual risks for any time frame other than the immediate post-construction condition (Time 0). As reported in the FS (Section 4.1.3):

> *As a long-term model is not available to predict the time to meet the PRGs, interim targets for risks and HIs were established to evaluate the potential for achievement of PRGs in a reasonable time frame, which was considered to be 30 years, commensurate with the site-specific contaminants and conditions. These interim targets are higher than residual risks once PRGs are achieved, and assume that further reductions with be achieved through MNR.*

The calculated post-construction risks and HI values are higher than the interim target risks and HI. Because much of the remedy relies on MNR, the lack of a residual risk estimation process for time intervals post-construction (up to year 30) makes the usefulness of the residual risk estimates limited and almost worthless in terms of comparing the protectiveness of the remedies.

Furthermore, there is very little difference in net risk reduction between Alternatives B and I for almost all COCs. For most of the COCs, the differences are less than a factor of 2 and sometimes much smaller (e.g., difference in HQ of 0.25). Given the very conservative assumptions that were used to calculate PRGs, differences in estimated risks by a factor of 2 or less are not significant. A more reasonable criteria for evaluating differences in estimated risk between alternatives would be a factor of 10, which should be considered the minimum significant difference given the limited sensitivity of these criteria. A probabilistic-type risk evaluation, which incorporates the quantitative uncertainties, would be a more appropriate approach.

This small difference in risk reduction between alternative remedy scenarios is likely due to the driving PRGs being based on background. The risk associated with background levels of COCs should be presented in a side-by-side comparison to the residual risk estimates in order to demonstrate the benefit of the remedial measures to the public. Based on the residual risks presented, any remediation beyond Alternative B (which does show a great degree of risk reduction from Alternative A, no action, than the difference between other alternatives) is unwarranted. The very large increase in costs for minimal and insignificant risk reduction between Alternatives B and I is not recognized in the FS.

In summary, the removal volumes in Alternative I cannot be justified as a cost-effective reduction of risk in comparison to other alternatives. Nor can the use of mixed criteria such as PRGs (and

RALs) from different alternatives (i.e., "E" and "F" applied either site-wide or within an SMA) be justified based on differences in risk outcomes that are with an order-of-magnitude. To adequately assess the alternatives, an accurate assessment of risk needs to be completed using the risks identified in the EPA-approved BHHRA and BERA. The improper modifications to the risk assessments and assessments of residual risk should be removed from the FS document.

EPA Position:

Residual risk is clearly defined in the 2016 FS as the cumulative risk associated with the PRGs, whether risk-based or otherwise. The use of a PRG associated with a background concentration, when that value is greater than a risk-based concentration, is consistent with EPA policy. LSS' claim that "remediation to background levels is not realistically achievable" is simply declarative and wholly unsupported by any information provided by respondents. In fact, the 2014 Kleinfelder report repeatedly cited by LSS in this dispute presents a simple mean upstream PCB concentration of 5.8 µg/kg. This value is essentially the same as the UCL on the mean of 5.6 µg/kg PCBs from the background data set and presented in Table 7.3-1 of the final RI. Thus, if the more recent data submitted by respondents are taken solely at face value, the background levels presented in the 2016 FS are not only realistically achievable, but may be high relative to more recent data.

The number of acceptable fish meals per unit of time represents nothing more than a calculation of post-construction or residual risk, based on predicted tissue concentrations using the models developed and used by the LWG. Consistent with the assumptions used in the BHHRA, post-construction fish consumption risks on a river-mile scale were evaluated using PRGs calculated based on a consumption rate of 49 g/day.

Respondents' assertion that "risks for Alternative A are based on "average concentrations" versus the "95% upper confidence limit" is directly contradicted by the information presented in the 2016 FS, which states in Section J2.1 "A site-wide average concentration for each COC – represented by the 95 percent upper confidence limit on the mean – was then calculated for each RAO 2 COC using ProUCL." We note that according to EPA guidance, the 95 percent upper confidence limit (UCL) of the arithmetic mean should be used when calculating the "average" concentration to represent the exposure concentration. Further, EPA is unclear of the basis for respondents assertion that the average PCB concentration in the BHHRA was 160 µg/kg in bass and 2,500 µg/kg in carp, as Table 3-12 in LWG's final BHHRA presents mean PCB (measured as Aroclors) tissue concentrations for whole body smallmouth bass and carp of 1,200 µg/kg and 1,700 µg/kg, respectively. The corresponding mean tissue concentrations for PCBs measured as congeners are 1,100 µg/kg and 2,800 µg/kg in smallmouth bass and carp, respectively.

Risk estimates associated with consumption of fish presented in the 2016 FS were calculated using sediment data to estimate tissue concentrations, while risk estimates in the BHHRA used measured tissue concentrations. For the purpose of evaluating the effectiveness of different alternatives, sediment concentrations were averaged separately for each section by side of river to account for the fact that the majority of contamination, as well as habitat for fish is located in the nearshore areas. Respondents provide no basis in statute, EPA policy or guidance that an analysis of risks in the 2016 FS must aggregate data exactly as was done in the baseline risk assessments.

See EPA's position to LWG's dispute issue 1k regarding measured versus predicted dioxin/furan risks.

No definition of "actual risks" or "absolute risks" is provided. However, it appears LSS believes that risks associated with background concentrations qualify as "relative." Risk is directly related to concentration, and does not recognize the basis for that concentration. Thus, risk estimates for two or more different COCs are "comparable" and additive.

As noted, post-construction COC concentrations in areas assigned dredging or capping were assumed to be zero, as the 2016 FS assumed clean material would be used for caps, and that the residual layer applied to dredged areas would consist of clean sand. The absence of a defensible fate and transport model precluded estimating COC concentrations with any degree of certainty in these areas for any time-frame beyond the immediate post-construction period. Regardless, the same metric is used for each alternative, and the resulting comparative analysis is adequate for FS purposes.

The use of interim targets is consistent with EPA's sediment guidance. The degree to which estimated post-construction risks approach the risk associated with the proposed cleanup goals provides a measure of the degree to which MNR must be relied upon to achieve the cleanup. If, as LSS postures, the lack of an estimation process for time intervals post-construction renders the residual risk estimates almost worthless, the most logical conclusion would be for the ROD to acknowledge that limitation and select Alternative H, as it is the only alternative for which final COC concentrations can be estimated with any certainty.

No justification is provided by LSS for the assumption that a factor of 10 in risk estimates is needed to distinguish between alternatives. The effective use of probabilistic methods is reliant on the distribution of the estimates for the terms to be varied. The LWG's attempt at a probabilistic analysis (2012 Draft FS Appendix E) relied on assuming distributions for the population representing various inputs because the underlying data regarding the shape of the distribution was unknown. Further, EPA noted in its 2013 disapproval of the LWG 2012 draft FS that EPA guidance on probabilistic risk assessment clearly notes that probabilistic methods should not be used to develop PRGs when point estimates were used in the risk assessment.

"Background risks" are explicitly included in the residual risk estimates presented in Appendix J1 for those COCs for which the PRG is based on background concentrations. Post construction risk estimates, and well as estimated costs, for Alternatives B and I are presented in the 2016 FS.

The 2016 FS does not conclude that the removal volumes in Alternative I are justified as "a cost-effective reduction of risk in comparison of other alternatives," rather, the comparative analysis evaluates the relative performance of each alternative in relation to each specific evaluation criterion. The determination of the merits of Alternative I relative to other alternatives was made in the Proposed Plan, and Respondents dispute rights do not extend to that document. Respondents provide no support from CERCLA, EPA policy, or guidance to support their assertion that an order of magnitude difference in risk outcomes is needed to distinguish between alternatives. PRGs are not applied as a "mixed criteria" in the 2016 FS, the same PRG for each COC is used in all alternatives.

LSS Dispute Issue 9 - RALs are not tied to PRGs and site risk

It is not clear how the RALs equate to risks, other than value for Alternative H, and only if based on the 10-6 risk-based PRG but not based on background. The risks from the RALs and background levels of COCs should be presented side-by-side to demonstrate the risk reduction for these alternatives.

Risk-based PRGs should be consistent with the spatial scales of the exposure scenarios used to characterize risk in the approved baseline human health and ecological risk assessments for evaluating cleanup alternatives. The spatial scales over which the PRGs are applied are a key element of the respective exposure scenarios being represented by the PRG. The spatial scales are as fundamental to establishing PRGs as the numeric values themselves. Various spatial scales were used in developing PRGs in the FS (Section 4.1.1): (1) Benthic risk was evaluated on a population level as the area exceeding RAO5 PRGs (2) 0.5 RM was used for RAO1 (sediment only) for direct contact exposure of people engaged in fishing activities, (3) 1 RM was used for RAOs 2 and 6 for the dietary exposure of humans and ecological receptors that consume fish and shellfish, and (4) Sitewide for RAO2. In the FS, COC concentrations were estimated on a rolling average developed from the surface sediment data in the FS database. Surface sediment results were averaged over a distance of 0.5 mile (RAO1) or 1 mile (RAOs 2 and 6) in successive 0.1-mile increments in both the east and west nearshore segments, and the navigation channel. Although the spatial scales match the baseline risk assessment exposure areas, the sediment concentrations calculated for the alternatives are not the same as in the baseline risk assessments and therefore, residual risks for the various alternatives cannot be compared to baseline conditions, except for sitewide conditions (see dispute issue 8 above).

For RAO2, two scales were used to derive two sets of PRGs, sitewide and 1RM, using consumption rates of 142 g/day (based on the subsistence fisher) and 49 g/day (based on the recreational fisher), respectively. However, the selected PRGs for RAO2 are shown to be the ones derived based on the sitewide scale (shaded green in Table B3-5). The 1RM scale PRGs assume that recreational fishers will only be exposed to that portion of the river, which is a very conservative and unrealistic assumption. The RALs for RAO6 only used the 1 RM scale. This corresponds with the home range of species such as smallmouth bass, hooded merganser, osprey, bald eagle, and mink that were evaluated in the BERA. Ecological risk is managed on a population scale and even if a home range is within a river mile, the contiguous population may be exposed over a larger area.

In summary, the spatial scales, exposure scenarios, and estimation of exposure concentrations for the remedy development and residual risk evaluations vary from those used in the BHHRA and no clear rationale is provided for the approach.

EPA Position:

It seems that the Respondent is confused between PRGs and RALs. PRGs are established in various media using risk-based values, ARARs, and consideration of background. PRGs are developed independent of spatial scales in Section 2 of the 2016 FS. However, PRGs are evaluated at relevant spatial scales based on exposure assumptions developed in the baseline risk assessments in Section 4 of the 2016 FS. Respondent agreed that the spatial scales used in the 2016 FS matched the baseline risk assessment exposure areas. The disparity in the risk estimates calculated in the baseline risk assessments for exposure to sediment and those in the residual risk estimate is due to the aggregation of the data. The baseline risk assessments aggregated data by dividing the site into discrete areas based on exposure (for RAO 1 direct contact to sediment, the river was divided into nearshore areas and then further divided into 0.5 river mile segments – RM 0-0.5, RM 0.5-1, RM 1-1.5, etc.) whereas the 2016 FS evaluated the same 0.5 river mile exposure assuming that the exposure could be to any 0.5 river mile (for RAO 1, the river was divided into nearshore areas and then divided into 0.5 river segments by 0.1 river mile increments – RM 0-0.5, RM 0.1-0.6, RM 0.2-0.7, etc.). Further, most of the risks in the baseline risk assessments were based on measured tissue data whereas the 2016 FS used models to predict tissue concentrations based on sediment concentrations. Again, the fish tissue data were aggregated by segmenting the river while the 2016 FS did not assume that fish reside only in a particular river segment, but could reside in any part of the river within that spatial scale. The BHHRA evaluated fish consumption on a Site-wide scale using 142 g/day consumption rate and a one river mile scale using 49 g/day. The 2016 FS used this same assumption and spatial scale; thus, is consistent with the BHHRA. Since EPA used this approach consistently to the no action alternative and to each of the remedial alternatives evaluated, the comparison of alternatives in the 2016 FS can be compared to the baseline conditions at any spatial scale considered.

In Table 2.2-3, several COCs have "A" under the columns for RAOs 3, 4, or 8. It is unclear why this is necessary. There are no data to justify selection of ARAR-based COCs as provided in Table 2.2-3a. The FS text simply states "contaminants that were detected in upland media (storm water and groundwater) that may potentially migrate to the river at concentrations that would exceed the Safe Drinking Water Act MCLs and national or State of Oregon water quality criteria were also designated as ARAR-based COCs." Data or references are required to substantiate this assertion. In addition, the rationale behind assignment of ARAR-based PRGs is not clear and transparent.

EPA Position:
All of the "A" designations under RAO 3 are incorrect and should be "R." See EPA position to LWG's dispute issue 1d regarding application of MCLs and ARARs.

For some COCs (PCBs and dioxin/furan congeners), the sediment PRGs (RAO2) that were developed using the FWM based on target tissue concentrations were assigned a value of zero. Therefore, the PRGs selected for these COCs are background. The mathematical rationale provided is that when using the FWM, dissolved concentrations alone are predicted to result in estimated tissue concentrations greater than the risk-based target. This indicates some flaw in the FWM. Appendix B also states that the FWM presented in detail in the Bioaccumulation Modeling Report (Windward 2015) was submitted to, but not approved, by EPA. However the sediment PRGs for RAO2 and RAO6 are based on this FWM. Note, for RAO6, sediment risk-based sediment PRGs could be estimated for PCBs and dioxins/furans (much higher than background). For the FWM, the OR AWQC were used as post-remedial water concentrations.

Note that LWG has disagreed with the use of AWQC in the FWM; instead upstream water concentrations should be used.

<u>EPA Position:</u>
EPA disagrees that surface water concentrations alone can result in tissue concentrations that could pose unacceptable risk. Such a statement indicates a fundamental lack of understanding of the Arnot and Gobas model used by the LWG. The Arnot and Gobas model is a complex, fugacity-based model that estimates tissue concentrations resulting from exposure through a variety of measures, including gill uptake and dietary exposure, as well as accounting of transformation and elimination through metabolic processes. The mechanistic nature of the model is such that certain model outputs in fact represent inputs to other portions of the model. For example, the dietary preference for certain fish may consist of a sufficient proportion of zooplankton and phytoplankton such that exposure via diet alone, of in combination with gill uptake may result in a tissue concentration exceeding risk-based concentrations, particularly in species that prey on planktonivorous fish. In fact, the LWG's submittal of Early Preliminary Remediation Goals (March 2009) presented sediment PRGs for several contaminants as "<0," indicating that a sediment concentration of 0 in conjunction with the input water concentration resulted in an estimated tissue concentration exceeding the risk-based target. The LWG did not identify this as "some flaw in the model" when it submitted the report to EPA for approval.

While the Bioaccumulation Modeling Report as submitted by LWG was never approved, EPA did notify the LWG on November 18, 2014, that the Arnot and Gobas food web model as calibrated by the LWG was approved. **[AR Doc # 100005458]** Since AWQC represent ARARs in surface water that must be achieved, EPA believes they appropriately represent surface water concentrations to calculate PRGs in sediment using the food web model.

It is also not clear if risk from background was accounted in the risk reduction. In addition, some of the post-construction calculated sediment concentrations are below background.

<u>EPA Position:</u>
Risk from background was accounted for in the residual risk if background exceeded the risk-based PRG. Post construction calculated sediment SWACs were calculated using a replacement value of zero (the assumption was that clean material would be used in caps and residual covers). If enough of the values in a SWAC area are replaced with zero, it could result in a concentration below background. This would mean that the alternative is more aggressive than necessary to achieve the PRGs. EPA acknowledges that after the remedy is constructed, surrounding sediment and upriver sediment will mix with the clean material which will result in some equilibrium concentration greater than the post construction SWAC, but could not be calculated due to too many unknown variables (area-specific deposition rates, depth of mixing, sediment transport rates in the Site, etc.) and is too difficult to compute without a functioning fate and transport model.

The RALs developed for dioxins and furans in the FS (Section 3.4.1.2) are based on several assumptions leading to low confidence and high degree of uncertainty. PRGs for dioxins/furans are less than or within the MDLs. The FS recognizes that due to low data density, interpolations *are required across large areas with no data, leading to large footprints that exceed these uncertain RALs.*

The RALs need to be related to the PRGs for the site that were developed from the EPA-approved BHHRA and BERA. The spatial scales, exposure scenarios, and estimation of exposure concentrations for the remedial levels, should be on the same basis as for the BHHRA and BERA. Remedial levels should be no lower than background for COCs that have PRGs that based on background. Uncertainty in remedial areas identified needs to be accounted for in the cleanup area assessment especially for COCs that have small data sets and low data density, such as dioxins and furans.

EPA Position:

PRGs developed for dioxins/furans are all quantifiable. All RALs developed for focused COCs, including dioxins/furans, are all greater than the PRGs. EPA agrees that there is a higher degree of uncertainty in the dioxin/furan areas delineated in the 2016 FS, but that the estimated costs are within the accepted cost range of +50/-30 percent. It is expected that that uncertainty will be resolved in remedial design.

LSS Dispute Issue 10 - PRGs and RALs are inconsistent with other sediment sites

EPA's Portland Harbor PTW value for total PCBs (200 µg/kg) is much lower than the hot spot remediation and expanded hot spot remediation values for the Hudson River site (30,000 and 10,000 µg/kg, respectively). Cleanup goals for other sites are significantly higher than the PTW concentration for Portland Harbor and were not defined as PTW for these other sites. For example, the PCB cleanup goal protective of human health is 386 µg/kg for Yosemite Slough in San Francisco, California; 1,240 µg/kg for Hunters Point, California; and 1,000 µg/kg for Fox River, Wisconsin. The cleanup goal for Passaic River in New Jersey is based on the background of 460 µg/kg. All of these cleanup goals protective of human health are greater than the 200 µg/kg PTW value for PCBs proposed for Portland Harbor.

PRGs developed in the FS using parameters and assumptions used in the baseline risk assessment are considered very conservative. For the BHHRA, upper end of the exposure parameters were used for estimating risks. For example, assuming a subsistence fisher would consume fish 149 g/day from the site alone is highly unlikely. Not refining these conservative assumptions for developing PRGs is considered unrealistic. The FS should utilize assumptions and targets that are reasonably achievable given the background conditions and other factors affecting implementability.

EPA's use of sediment PRGs for riverbanks, even on areas rarely inundated and without considering attenuation, is technical inappropriate. Delineations of groundwater plumes and riverbanks, and a zero post-construction restoration time frame are arbitrary. There is a total lack of data and analysis as to what risk considerations are driving the specific remedial actions delineated (and therefore how this will be refined in the design phase when further data/analysis is available) and what specific remedial actions will be implemented in which areas driven by *those risks. This arbitrary delineation is then carried forward into the evaluation of alternatives and given weight for assessing the relative effectiveness of alternatives.*

EPA's Portland Harbor PTW value for total PCBs (200 μg/kg) is much lower than hotspot remediation and cleanup goals for other PCB-imapcted sites. EPA should modify the PTW values in the FS to make them consistent with other sediment sites such as the Hudson River site noted above.

EPA Position:

As a general matter, the NCP provides a framework for assessing and managing risks at Superfund sites. More information and many recommendations for assessing both human health and ecological risks and developing cleanup levels are provided in several guidances and fact sheets issued by the Superfund program. These guidances by design are not prescriptive and provide the regions with discretion to make decisions based on site-specific data and information. A principal tenant of the Superfund program is that all baseline risk assessments and cleanup levels should be based on site-specific exposure data and the reasonable maximum exposure that could occur at a site. Cleanup levels typically are based on site-specific risk, ARARs or background.

Based on site-specific information, EPA applies the reasonable exposure pathways, exposure factors, and risk level within the 10^{-4} to 10^{-6} risk range(with 10^{-6} being the point of departure) for choosing cleanup levels appropriate for the site. Different site-specific circumstances can account for the variability in cleanup goals between sites. Sediment cleanup goals and fish tissue targets may not be set at risk-based concentrations, where site-specific conditions, background concentrations, and available remedial technologies indicate that risk-based goals are not expected to be achievable. Under these circumstances higher cleanup levels may be set, in addition to fish consumption advisories to reduce exposure and to achieve protection.

The Portland Harbor risk-based goals for individual contaminants are based on 10^{-6} cancer risk or a non-cancer hazard of one and achieve a cumulative cancer risk level at 10^{-5} to comply with Oregon's residual risk ARAR for this Site. That level of protection for most exposures is achievable at Portland Harbor based on current information. Where sediment background concentrations are higher than that risk level, background concentrations are used.

Risk-based PRGs in the 2016 FS are developed consistent with the exposure assumptions in the baseline risk assessments. Consistent with the BHHRA, both the subsistence fisher consumption rate of 142 g/day and the recreational fisher consumption rate of 49 g/day were used to develop risk-based PRGs in the 2016 FS (see Appendix B). The Respondent does not provide any detail as to which 2016 FS assumptions and targets are not readily achievable given background conditions nor provides which factors affecting implementability are not reasonable. EPA believes that the 2016 FS assumptions and targets are reasonably achievable, considered background conditions, and factors affecting implementability.

LSS complained that our PTW values and our PRGs for PCBs were lower than cleanup levels at other sites. As stated above, every cleanup decision is based on site-specific circumstances. Likewise, the cleanup decision itself can be structured in many different ways making simple comparisons of “cleanup” numbers misleading at best and just plain wrong at worst. A cursory review of the site decision documents for the sites and “numbers” referenced by LSS illustrates this point. The Hudson River numbers LSS references were hot spot remediation levels that required removal, not the final cleanup goals. The Yosemite Slough is a removal action and may only be addressing ecological risks. The Hunters Point site from what we could tell has not made a final cleanup decision at this time. Furthermore, 1ppm is only the remedial action level at the Fox River site, not the final cleanup goals which are not significantly higher than PRGs proposed for Portland Harbor.

LSS Dispute Issue 11 - Methodology for calculating background concentrations
EPA’s proposed background values based on inappropriately derived upstream bedded sediment statistics are unlikely to represent achievable cleanup levels for the site. The FS also does not present background concentrations for surface water and does not present sediment background concentrations for all chemicals with sediment PRGs.

A sediment remedy must include evaluating what is deposited within the Study Area, both physically and chemically (i.e., potential future bedded sediment equilibrium). EPA has not conducted such an evaluation. The cleanup goal for PCBs of 9 ppb based on EPA's calculation of background concentrations is not achievable. Background should not be used to establish cleanup goals when likely ongoing contaminant inputs from upland sources within the Site and upriver of the Site exceed EPA’s calculation of background. The LWG provided EPA an evaluation of equilibrium concentrations for the Site that are a much more reliable indicator of future concentrations that can be achieved.

More specific detail is provided below for PCDD/F compounds in sediments and other COCs and media.

EPA Position:
Background values were derived using data specific to the Portland Harbor site and overall watershed. Use of site-specific information is consistent with EPA background guidance, and because site-specific data are available, comparisons to other urban watersheds, which may or may not be similar to Portland Harbor, are not relevant.

See EPA’s position to LWGs dispute issue 1g.

LSS Dispute Issue 11a - Background concentrations PCDD/F compounds in sediment
Sediment PRGs for RAO2 and RAO6 as well as riverbank PRGs for RAO9 for the five PCDD/Fs congeners are based on background concentrations. Background PCDD/F concentrations for individual congeners are presented in Appendix B, Table B2-4 of EPA’s FS.

EPA uses new methods for deriving these levels that appear significantly different from both EPA’s methods for other chemicals as well as past LWG input on this subject. Sediment PRGs *for RAO2 and RAO6 as well as riverbank PRGs for RAO9 for the five PCDD/Fs congeners are based on background concentrations.*

The background values are based on limited and poor quality data (with elevated detection limits). In fact, only one congener has sufficient data (1,2,3,4,7,8-HxCDF) to calculate a background value and even that is limited (13 of 31 samples were non-detects). Thus, most of the background "values" are based on a 95% UCL of the detection limits. The background values also appear skewed quite low compared to other urban watersheds.

The background values estimated based on this limited data and approach, furthermore, are low and approximately an order of magnitude lower than values from other regions and watersheds. For example, a memorandum published by EPA in 2010 provides a good summary of background levels for dioxins/furans in sediment, which range from approximately 2–5 parts per trillion (ppt) as TEQs. It also summarizes values from Puget Sound which include a TEQ value of 4 ppt for non-urban areas but allowing up to 10 ppt as TEQs for open water disposal; this value is also used in San Francisco Bay and elsewhere. (https://klamathrestoration.gov/sites/klamathrestoration.gov/files/EPA%20Klamath%20dioxin%20memo%201-13-10%20final.pdf). The Duwamish Waterway FS establishes an upper bound background value for dioxins/furans as 11.6 ppt TEQ.

Background values in other regions and watersheds are expressed as TEQs, which is generally the manner in which cleanup goals for dioxins/furans are expressed. For Portland Harbor, EPA used 5 individual congeners. The individual congener background values provided in Appendix B of the FS and in the PRG tables for RAOs 2 and 6 can be converted to TEQs using TEFs, which results in a value of 0.56 ppt on a TEQ basis (since the 5 congeners equate to the majority of the risk, this value may be slightly biased low, but probably less than 10% of the total TEQ). This background value is an order of magnitude or more lower than the range of values, mainly for non-urban areas, from the literature. A study to better define background levels for dioxins/furans is necessary since the calculated risk-based PRGs are well below even these low-biased background levels resulting in the background values being adopted as the final PRGs. Otherwise, it is unlikely that the remedies for dioxins/furans will be successfully implemented and estimated risk reductions for dioxins/furans will be realized. This latter issue addresses the validity of the alternatives analysis and its biased outcome.

It should also be noted that no background values are listed for RAOs 1 or 3. Those PRGs are expressed as TEQs and data is lacking to identify a background level on a TEQ basis. This needs to be rectified; those PRGs may be below background. In fact, the PRG for RAO3 is 4 orders of magnitude below the MCL and is likely not measurable at that level. Overall, providing PRGs that are below MCLs is inconsistent with other cleanup actions under CERCLA or other programs. Cleanup to below MCLs is unlikely to be achievable.

EPA Position:

As noted in Section B2.4, background for 1,2,3,7,8-PeCDD, 2,3,4,7,8-PeCDF, 2,3,7,8-TCDD, 2,3,7,8-TCDF were established as the 95th percentile of the detection limits in the background data due to the very low frequency of detection of these analytes in the background data set. Thus, any detection of these congeners can be construed as representative of contamination. Respondents' calculation of a background value on a TEQ basis appears contradicted by their subsequent statement that "data is lacking to identify a background on a TEQ basis." EPA continues to believe that background values in sediment expressed solely as a TEQ would be inconsistent with the risk assessments, which assess exposure via bioaccumulation through the food chain. Information submitted to EPA by the LWG in its validation of the food web model for dioxin/furans clearly demonstrates that the individual congeners bioaccumulate at different rates, and information presented in the 2016 FS Section B2.2 demonstrates that calculated TEQ values in sediment do not correlate with calculated TEQ values in biota. The PRG for dioxin/furans is based on Oregon water quality standards.

LSS Dispute Issue 11b - Background concentrations for other COCs and media

The FS (Section 2.2.2.4) states that only sediment background concentrations were estimated and background concentrations for other media could not be calculated due to insufficient data. However surface water background concentrations were calculated in the RI. Upriver surface water background concentrations COCs are orders of magnitude higher than the ARARs based on the AWQC. Note, the background UCLs for upriver surface water (dissolved concentrations with outliers removed; Table 7-4b of RI) vs RAO3 AWQC-based PRGs. For example, the background UCL concentrations for DDT, PCBs and TCDD Teq are all significantly less than the respective RAOs for these substances:

- *background UCL for DDT = 0.000114 µg/L and the ARAR (RAO3) is 0.00002 µg/L*
- *background UCL for PCBs = 0.000126 µg/L and the ARAR (RAO3) is 0.000006 µg/L*
- *background UCL for TCDD Teq = 0.000126 µg/L and the ARAR (RAO3) is 0.000000033 µg/L*

Because of the deficiencies in determining the background levels, a new background study for sediment, surface water and tissue needs to be conducted in the design phase. The results of this evaluation need to be used to update PRGs, RALs and SDUs.

EPA should not use background to establish cleanup goals when likely ongoing contaminant inputs from upland sources within the Site and upriver of the Site exceed EPA's calculation of background. A better approach was provided by the LWG using equilibrium values.

EPA Position:

See EPA's position to LWG's dispute issue 1g.

Respondents refer to Table 7-4b of the RI; however, the Final RI does not contain a Table 7-4b.

LSS Dispute Issue 12 - Benthic risk models do not honor the measured data

EPA made extensive changes to the benthic approach for this FS, but those changes are still inconsistent with the comprehensive benthic risk approach contained in the approved BERA). The FS states: "The protection of benthic species to contaminated sediment is evaluated using the benthic risk area defined by an order of magnitude greater than the RAO5 PRGs. The post-construction interim target for RAO5 was established at 50% reduction in the area posing unacceptable benthic risk." So, instead of using the CBRA, EPA now maps benthic PRG exceedance factors on a point-by-point basis and uses a 10 times exceedance factor to identify areas of concern. EPA then concludes that if 50% of this area is actively remediated, the alternative is "protective" on an interim basis. It is completely unclear how this new method is:

1) in any way more accurate or consistent with the BERA; and 2) more predictive of benthic risk or the effectiveness of the alternatives, as compared to simply using the CBRAs, which are entirely consistent with the BERA.

Furthermore, and most importantly, the benthic risk models used by EPA do not honor the measured data. Although the LRM and FPM are model predictions using data from the toxicity texts conducted with site sediments, much of the measured data is not honored. Any modeled risk for benthic invertebrates that ignores actually toxicity testing results needs to be assessed in weight-of-evidence and river-mile specific decision-making. The benthic risk footprints should not extend into areas shown to have a lack of toxicity based on actual laboratory toxicity tests. This error has been carried through the alternatives analysis and therefore has biased the selection of alternatives for SMAs in the FS.

EPA should modify the benthic approach in the FS so it is consistent with the BERA and honors all measured data.

EPA Position:

See EPA Position to LWG dispute issue 1b.

The benthic risk models were not used by EPA in the 2016 FS. The benthic risk models were used by LWG contractors (Windward Environmental) to determine risks in the BERA. EPA used the outputs of those models provided as a GIS layer in developing the maps in the 2016 FS, Appendix D10. However, the comprehensive benthic risk map (2016 FS Figure 4.1-1) was developed using interpolation of surface sediment concentrations exceeding the RAO 5 PRGs. Since EPA is not requiring action based on these PRGs, they will be monitored post construction until such time as they are achieved.

LSS Dispute Issue 13 - Food Web Model (FWM) for DDx and PCDD/Fs

The FWM is used by EPA to back-calculate concentrations of chemicals of concern (COCs) in sediment associated with acceptable, risk-based human health and ecological concentrations in fish tissue as calculated using the baseline risk assessment (Kennedy/Jenks, 2013). This influences sediment PRGs and hence RAOs, so uncertainty originating with the FWM cascades, having compounding effects on the evaluation of remedy alternatives, and could result in additional remediation costs with no meaningful gains in risk reduction. We identify the following shortcomings with EPA's application of the FWM at the Site:

A comprehensive and detailed Conceptual Site Model (CSM) for the Site in total, and for the relationship between COC sediment and fish tissue concentrations specifically, has not been presented by EPA. This means that EPA's chief assumptions for the FWM related to steady-state conditions (in a major river), the completeness of the site characterization dataset, regional contributions of COCs, and the apparent relationship between sediment and fish concentrations.

Based on an examination of the empirical data for the Site, no statistically significant relationship is observed between sediment and fish tissue concentrations for DDx and PCDD/Fs at the concentrations relevant to risk decision making. This means that the FWM - which *assumes such a relationship exists – is not reliable and that the conclusions reached on its basis are fundamentally inaccurate.*

Good modelling practice was not used by EPA for the FWM, and in particular sufficient model documentation detailing the work does not exist. Adequate model documentation is one of several criteria used by EPA and other international regulators for determining the acceptability of a model for regulatory decision making (USEPA 2009, EFSA, 2014, Grimm et al., 2014).

EPA should not use their FWM to evaluate sediment PRGs if there is no statistical relationship between sediment and fish tissue concentrations for key COCs such as DDx and PCDD/Fs.

<u>EPA Position:</u>
See EPA's position to LWG's dispute issue 1l.

<u>LSS Dispute Issue 14 - Overly prescriptive and flawed approach used to assign remedial technologies</u>
The FS acknowledges uncertainties in site characterization and the conservative assumptions used to form the basis for associated technology assignments, however EPA continues to use a prescriptive set of technology evaluation and scoring criteria to determine the technologies to be applied in each area of the site and, with the exception of a vague paragraph in Section 3.8.1, the FS is silent regarding the degree of flexibility that is envisioned to be available during remedial design to refine technology assignments based on the additional information gained through future pre-design investigations. This will lead to a lack of flexibility with regard to technology assignments, depth of removal, potential improvements in technology, design efficiencies to address remedial and CWA/ESA requirements, etc.

EPA should clearly explain the conditions under which changes to major alternative elements (e.g., changes in technologies assignments, methods to address PTW, methods for determining treatment and disposal requirements, requirements for rigid containment) might be considered or allowed. EPA should explain how new data, including the "initial conditions" assessment will affect the selection of alternatives and the RAL boundaries based on current surface sediment concentrations. The FS should include language to allow for updates to risk assessments. EPA should incorporate decision frameworks for proposing equally or more effective capping options or other technology refinements based on detailed design-level evaluations and new data.

Specific examples of EPA's flawed approach for assignment of remedial technologies:
• EPA makes unsupported assumptions regarding nature and extent of contaminated groundwater discharge which drive inappropriate, prescriptive technology assignment decisions that fail to provide flexibility to develop appropriate site-specific designs and mandate use of potentially unnecessary materials (e.g. reactive amendments and/or cap armor).
• The FS fails to provide evidence supporting speculative assertions of groundwater impacts, and selectively ignores facts including the physical effects of upland controls on contaminant transport/mobility (i.e., significant reduction in advection) which would otherwise allow for remedial design that considers, and is compatible with, upland SCMs. Similar to EPA's treatment of riverbank areas (Item 18 below) arbitrary assumptions regarding nature/extent of contaminated groundwater are carried forward into the evaluation of alternatives and given

weight for assessing the relative effectiveness of alternatives with respect to RAOs 4 and 8, which biases the outcome of alternative selection.
• While EPA's decision trees prescribe specific technologies amenable for use under heavy structures, it fails to consider the need for flexibility during design to adapt to any number of other site-specific constraints including slope stability, proximity to nearshore structures, etc. and preclude use of other technologies of potentially equivalent effectiveness.

EPA should modify the FS to clearly explain the conditions under which changes to major alternative elements might be considered, explain how new data will affect the selection of alternatives and the RAL boundaries based on current surface sediment concentrations, include language to allow for updates to risk assessments, and incorporate decision frameworks for proposing equally or more effective capping options based on detailed design-level evaluations and new data.

EPA Position:
The Respondent is confusing the requirements for an FS with the requirements for a ROD. The sole purpose of the FS is to develop remedial alternatives to be compared to each other in order to select a preferred alternative. The technology assignments in the 2016 FS are based on current information about the Site. The 2016 FS makes specific assumptions based on current conditions to develop remedial alternatives that can be compared to each other to inform remedy selection. Costs cannot be derived in the FS unless a technology is selected and evaluated. EPA used several lines of evidence based on site conditions described in the RI report to determine the appropriate technology to apply to various areas of the Site. The information and flexibility Respondents seek to be discussed in the 2016 FS do not inform the evaluation of the NCP criteria and are more appropriately discussed in the ROD. Thus, EPA does not consider this a dispute issue for the 2016 FS.

LSS Dispute Issue 15 - Prescriptive dredge residuals management strategy
The prescribed application of 12-inches of sand across the entire dredge footprint (amended with AquaGate+PAC2 in areas where PTW present) is very poorly supported. The FS is misleading in stating that the placement of sand (and GAC in areas where EPA has speculated that PTW is present) immediately following dredging will eliminate the need for additional dredge passes. The FS indicates that sediment cores would be taken post-placement to verify thin-layer residual cover successfully reduces residuals concentrations. It is inappropriate to assume a 12-inch layer of residuals management cover will be applied across the entire dredge footprint, without providing a strategy that will determined the necessity for thin-layer placement and flexibility to develop an appropriate thickness.

As PAC can be toxic to benthic organisms, overall quantities, where and how it is applied warrants more thoughtful consideration. The FS neglects to consider the physical stability of PAC in the deployment of the thin-layer residuals cover. PAC will be ineffective if it immediately washes away. The FS neglects to consider any possible unintended consequences that may be posed by transport/erosion and aggregation of PAC (with, or without adsorbed contamination) *in depositional areas. The assumed performance requirements for this residuals strategy are unclear.*

The prescriptive dredge residual strategy should be removed from the FS. If left in, the strategy and rationale for the residual management approach should be clearly explained, and a flexible, objective approach to assessing the need for and approach residual management should be allowed.

2 The text makes numerous inappropriate references to specific commercial products (i.e., AquaGate+PAC, Aquablok) as components of the conceptual remedial design. The FS should provide flexibility to consider other commercially products for a given class of technologies.

EPA Position:
EPA made an assumption in the 2016 FS regarding the type and quantity of material to be used in dredge residual management in order to develop costs. The actual type and quantity of material needed for dredge residual management will be area-specific and determined in remedial design. However, EPA acknowledges that the use of a residual management layer can reduce costs of both post dredge sampling and multiple dredge passes to achieve remediation goals.

LSS Dispute Issue 16 - Inappropriate use of rigid containment technologies
EPA assumes the use of sheet pile barrier walls as dredge water quality control measures based on the suspected presence of NAPL will support the short term effectiveness of all alternatives. The FS still fails to adequately evaluate the implementability, effectiveness and cost of this particular technology relative to other technologies and BMPs.

In making gross assumptions for this FS, EPA has disregarded the complexity of constructing such barrier walls (e.g. consideration of structural components such as king piles and structural bracing, or more complex cofferdam structures) and the associated impacts this will have on numerous aspects of remedy implementation ranging from construction duration (e.g. time required to install walls, and impacts to dredge production rates) to the overall net benefit and cost effectiveness relative to other means. EPA also continues to show figures that depict sheet piling in greater than 50 feet of actual water depth, which is technically infeasible. These figures also imply that sheet piles will be installed in the navigation channel, which would infeasibly obstruct vessel traffic. Sheet pile would also impact ongoing water dependent operations and nearshore fish migration does not evaluate whether sheet piles in the navigation channel could be permitted by USACE.

Because of the technical infeasibility of the use of sheet pile barrier walls, their consideration as a feasible technology for dredge water quality control measure should be removed from the FS.

EPA Position:
EPA disagrees that the use of sheet piles has not been adequately evaluated relative to other control technologies and BMPs. Sheet piles are a representative engineered rigid control measure identified and evaluated for sediment dispersion control in the 2016 FS. However, that representative approach does not preclude other types of rigid control measures for consideration

during remedial design. As stated in the 2016 FS, Appendix O, EPA agrees that depth can limit the use of suitable engineered options for controlling releases, and deep water depths can preclude the use of sheet piles. EPA assumes that engineered rigid containment will be utilized when NAPL was present in water depths less than 50 feet.

Engineered rigid control measures were evaluated holistically within the 2016 FS for their use in reducing or eliminating short-term releases of contaminants during construction and not on a location-specific basis. Thus, the 2016 FS does not present figures indicating design level logistical details regarding location and depth of engineered rigid control measures. Location-specific evaluations for feasibility of sheet pile versus other types of engineered rigid control measures, including placement within the navigation channel, were beyond the scope of evaluation of the 2016 FS. Details regarding sediment dispersion control and location-specific engineered rigid control measures will be determined during remedial design which is the appropriate time for those types of evaluations.

Alternative-specific costs for purchasing, installing and removing sheet pile walls are presented in Appendix G of the 2016 FS. The unit costs were developed by the LWG in the draft 2012 FS on a horizontal linear foot basis. Quantities for sheet pile lengths used in the detailed alternative cost estimates and presented in the 2016 FS, Table D2.j (in horizontal linear feet), were holistically estimated for each alternative by encircling all PTW dredge and/or capped areas with silt curtains assumed for the remainder of dredged and/or capped areas.

See EPA's position to LWG's dispute issue 2b regarding rigid containment.

The determination of technical feasibility of engineered rigid control measures is highly dependent on site specific conditions. As stated in Appendix O of the 2016 FS, EPA agrees that depth can limit the use of suitable engineered options for controlling releases, and deep water depths can preclude the use of sheet piles. However, blanket elimination of the technology is not warranted. EPA assumes that engineered rigid containment will be utilized when NAPL was present in water depths less than 50 feet.

<u>LSS Dispute Issue 17 - Flawed evaluation used to determine whether PTW can be reliably contained</u>

Notwithstanding Arkema's objection to EPA's definition of PTW, and assertion it is present offshore of the Arkema site, the approach used to determine applicable remedial technologies to address PTW in the draft final FS is flawed because it is based on a simplistic, overly conservative screening analysis and does not include standard engineering methods used to assess and ensure reliability. Additionally, EPA neglects to consider the current state of practice for reactive capping.

According to EPA, PTW is a concept used in the NCP to characterize contaminant source material (USEPA 1991). PTWs are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. In the 1991 guidance, EPA stated their expectation that PTW would be treated, wherever practical, because of current technical limitations of long-term reliability of containment technologies. The long-term reliability of *containment of certain NAPL PTWs has improved through the development and implementation of reactive capping, as demonstrated by EPA (USEPA 2013). The draft final FS does consider and propose reactive capping but uses a flawed, simplistic screening analysis to limit its use through designating certain SMAs as PTW NAPL/NRC, reflecting those areas where purported NAPL is deemed not reliably contained (NRC). Furthermore, the draft final FS is not consistent with the EPA guidance on principal threat and low-level threat wastes (LTW) (USEPA 1991), as it does not differentiate PTW from LTW NAPL based on toxicity, mobility, and (realistic) reliability of containment, but uses NAPL and PTW interchangeably. For instance, for shallow areas it states that NAPL or PTW that is not reliably contained within an SMA would be dredged to the lesser of the RAL concentrations or 15 feet.*

To determine the boundary for where PTW can be reliably contained, two limited capping options were modeled in Appendix D to determine the maximum concentrations of PTW material that would not result in exceedances of AWQC in the sediment cap pore water after a period of 100 years. Contaminants modeled were chlorobenzene, dioxins/furans, DDx, naphthalene, PAHs, and PCBs. Appendix D contains the following errors or ommissions:

• The objectives of the analysis are not clearly identified. The document states "this appendix is evaluating whether or not PTW at the Site can be reliably contained under specific assumptions". However, at the end maximum containable sediment concentrations of 320 µg/kg and 140,000 µg/kg for chlorobenzene and naphthalene are presented;

• The two potential active cap designs modeled (thickness of capping layers and amount of active material in cap for a reasonably conservative approach and a more aggressive augmented capping approach) are not representative of the current state of practice for reactive capping and so cannot be used to determine the contaminant concentrations that cannot be reliably contained;

o The reasonably conservative approach (12-inch active layer containing 5% activated carbon by weight) is not applicable for NAPL sites. The example site referenced (Berry's Creek in New Jersey and Bailey Creek, Fort Eustis in Virginia) are likewise not NAPL sites. Additionally, Berry's Creek represents a very small pilot-scale test of reactive cap technologies.

o The more aggressive augmented capping approach (12-inch active layer containing 20% activated carbon by weight) is also not applicable for NAPL sites. Organoclay is a more applicable and effective amendment for NAPL site (McCormick Baxter and West Branch Grand Calumet River).

o GAC may have a greater absorption capacity than organoclay on an equivalent weight basis with regards to some dissolved phase contaminants, but it can easily be fouled by NAPL.

• The long term reliability of a reactive cap is a direct function of the thickness of the reactive layer and the amendment(s). A more reliable reactive cap with a thickness greater than 12-

inches and consisting of a lower layer of organoclay and an upper layer of GAC should have been considered in Appendix D.

• Maximum porewater concentration of chlorobenzene used as a continuous source term in the model is based on the relatively old Remedial Investigation (RI) database and is not representative of current conditions, let alone for the next 100 years. In addition, EPA has used data that was not collected pursuant to the RI. EPA has used reconnaissance data collected using a Geoprobe rig. The data are unacceptable for and cannot be used to represent porewater chlorobenzene concentrations. Therefore, the maximum porewater concentration EPA used is based on inappropriate data and needs to be replaced in the model. Since the RI data collection, a barrier wall and pump and treat system has been installed along the shoreline of the Arkema site. It is anticipated that any remaining dissolved-phase chlorobenzene left beneath sediments (stranded wedge along toe of riverbank) will continue to naturally attenuate. Furthermore, maximum data are no appropriate for assessing engineering performance, including reliability. A more appropriate input parameter is the 90th percentile concentration.

• A range of seepage velocities were evaluated (0.3, 3, and 30 cm/day), representing the minimum, average, and maximum values measured at the Site. However, actual seepage velocities in SMA 7W are likely lower than 0.3 cm/day due to presence of barrier wall and pump/treat system.

EPA should revise the active cap modeling calculations to be transparent and clearly explain the assumpions in the model, model the active cap layers using current state of practice assumptions, utilize realistic long-term source concentrations in the cap model, and use a range of seepage velocities.

EPA Position:

Consistent with the NCP and EPA guidance, PTW was identified based on a 10^{-3} risk, source material (NAPL) within the sediment bed. As noted in "A Guide to Principal Threat and Low-Level Threat Wastes" (Superfund Publication 9380.06FS, November 1991):

> Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. They include liquids and other highly mobile materials (e.g., solvents) or materials having high concentrations of toxic compound

EPA expects to use treatment to address the principal threats posed by the Site, wherever practicable, consistent with the NCP (40 CFR §300.430) and EPA guidance. However, based on the technology assignment process, if sediment classified as containing PTW is located in an area designated for capping, then a reactive cap will be assumed for that area to meet the preference for treatment and meet surface water applicable or relevant and appropriate requirements (ARARs). As such EPA determined what PTW may potentially be reliably contained based on modelling representative site conditions and capping options to determine the maximum concentrations of PTW material that would not result in exceedances of human health based water quality criteria. While modeling indicates that there may be an increase in the potential to control the material, it is not deterministic that that will in fact be the case for all portions of the site. As such, the modeling information is useful as part of the nine evaluation criteria, but it not relevant to the determination of PTW.

The 2016 FS relied on location specific technology assignments to develop remedial action alternatives for evaluation in the detailed and comparative evaluation of remedial alternatives. The technology assignment process considered site specific information such as water depth, current and future navigation uses, PTW, contaminated groundwater plumes, structures, wind and vessel wake generated waves, sediment deposition rate, sediment bed slope, the presence of cobbles, rocks and bedrock, propeller wash, debris, and the vertical extent of contamination. Consideration of these site specific factors was conducted in a technically appropriate manner.

EPA relied on observations of NAPL to identify areas where NAPL may be present and employed a site-specific capping model to determine whether COCs at the Portland Harbor site can be reliably contained. As mentioned in Section 3.2.2.2 of the 2016 FS “This is an appropriate model to make FS-level decisions and is sufficiently rigorous to be used for decision-making at the FS phase. More rigorous modeling may be conducted as needed in remedial design.” It should be noted that the identification of NAPL and not reliably containable material in sediments offshore of the Arkema site are not mutually exclusive. Rather areas identified as containing NAPL were also found to contain levels of chlorobenzene that were determined to be not reliably containable.

The 2016 FS also developed a series of generic cap designs that incorporate reactive materials. This includes the “significantly augmented reactive cap” that utilize organoclay mats and low permeability materials to contain NAPL and reactive caps that utilize particulate activated carbon (PAC) mixed with sand to a PAC concentration of 5 percent by weight to contain highly toxic PTW. These FS level cap designs are consistent with the application of reactive caps at contaminated sediment sites around the country including the McCormick and Baxter site in Portland, Oregon and the River Mile 10.9 removal action in Lyndhurst, NJ.

This comment misrepresents the cap designs utilized in the 2016 FS. The 2016 FS relies on a “significantly augmented reactive cap” for areas were NAPL will be left in place. The significantly augmented reactive cap relies on organoclay mats and low permeability materials to contain NAPL and consists of the following elements:

- Chemical Isolation Layer: 1-inch organoclay mat.
- Low Permeability Layer: 17-inch layer of fine grained sand or other low permeability material
- Physical Isolation Layer: 12 inches of sand.
- Stabilization Layer: 6 inches of armor stone.

Reactive caps are utilized for areas where highly toxic PTW will be left in place. As noted in the comment, activated carbon is not considered suitable for NAPL due to the potential for fouling.

Reactive caps rely on a 12 inch layer of sand and powdered activated carbon (PAC) at a concentration of 5 percent by weight to contain highly toxic PTW and consists of the following elements:

- Chemical Isolation Layer: 12-inch layer consisting of approximately 50 percent sand and 50 percent AquaGate+PAC.
- Physical Isolation Layer: 18 inches of sand.
- Stabilization Layer: 6 inches of beach mix or armor stone.

For the significantly augmented cap, an organoclay mat that is effectively equivalent to four times the amount of activated carbon typically placed in a cap was conservatively assumed. The conservative assumption of a low permeability layer, COC degradation and no deposition were also used in order to contain the maximum possible contaminant concentration with this cap. The use of an organoclay mat and an upper layer of GAC (or PAC) may be considered during remedial design.

The model was used to estimate the maximum concentration of chlorobenzene that can be reliably contained using the significantly augmented reactive cap. The effects of the barrier wall and pump and treat system can be used during remedial design activities.

Any seepage velocities being influenced by the presence of the barrier wall and pump-and-treat system should be empirically collected prior to design for the construction of a cap based on site-specific criteria. The range of seepage velocities evaluated in Appendix D of the 2016 FS were selected to better understand contaminant fate and transport under a range of conditions.

The assumptions used for this analysis are outlined in the 2016 FS, Appendix D, Section D7.4 and Section D7.5, and are in line with current state of practice. A range of seepage velocities were evaluated (0.3, 3, and 30 cm/day), representing the minimum, average, and maximum values measured at the Site. As noted above, seepage velocities that consider the presence of the barrier wall and pump and treat system may be considered during remedial design. The assumptions used for this analysis are explained as follows:

- a 12-inch active layer with “active layer loading of the augmented cap of 0.48 lb/ft2/cm” was assumed which is four times the amount of activated carbon typically placed in a cap
- “a low permeability layer limiting seepage velocity to 0.3 cm/day was assumed” to represent a conservative value for seepage velocity
- degradation was assumed to incorporate effects of degradation of chemicals due to the long residence time in the cap
- “No sediment deposition on top of the cap” was conservatively assumed
- No consolidation was assumed to take place in the cap or in the underlying sediment

LSS Dispute Issue 18 - Riverbank contaminants adjacent to the Arkema Site

PCBs are listed as a riverbank contaminant at Arkema, but have only been detected in small number of samples below the applicable screening levels (with one exception, one sample slightly exceeded a conservative bioaccumulative SLV). The FS references an attached riverbank *database, but the database was not included. Consequently, LSS continues to have no way to verify any of EPA's FS decisions regarding remediation of the river banks. Regardless, prior issues with EPA's source control approach remain. Two key issues are (1) risk-based PRGs should not be established based on exposure pathways being evaluated as part of the upland source control evaluations under DEQ and (2) that none of these upland media were evaluated in the BLRAs or RI. EPA's use of sediment PRGs for riverbanks, which were even applied to areas rarely submerged by the river and without considering fate and transport (e.g., attenuation), is technically unsupportable and inappropriate. Delineations of groundwater plumes and riverbanks, and a zero post-construction restoration time frame are arbitrary. There is a total lack of data and analysis as to what risk considerations are driving the specific remedial actions delineated (and therefore how such analyses will be refined in the design phase when further data/analysis is available) and what specific remedial actions will be implemented in which areas driven by those risks. This arbitrary delineation is then carried forward into the evaluation of alternatives and used to assess the relative effectiveness of alternatives. This appears to significantly bias the outcome of alternative selection.*

Source control measures taken at the Arkema Site have largely eliminated the stormwater pathway from this site. Groundwater controls, namely the installation of a slurry wall and a groundwater extraction and treatment system designed to prevent migration from the uplands to the river, have eliminated the groundwater pathway.

The June 2016 FS fails to include a discussion of upland source controls that have been implemented as well as failing to include anything related to the performance of source controls in the remedial evaluations.

The FS report should be modified to include appropropriate risk-based PRGs developed for riverbanks rather than sediments and should acknowledge and include a discussion of upland source control measures in the remedial evaluations.

EPA Position:
See EPA position to LWG dispute issue 1q.

LSS Dispute Issue 19 - Updates to risk assessments
The FS should include language for allow for changes in pre-design work, to allow for updates to risk assessments. For example, if sediment and/or fish tissue samples are collected which show concentrations less than target levels, then PRGs/RALs would need to be revisited. Similarly, if additional studies on benthic toxicity are conducted for a portion of the river, those results should be used to update the remedial footprint for RAO5. Several source control actions have been undertaken and completed since the RI dataset was collected. Thus, areas of the river, COCs and media previously shown to show unacceptable risk may no longer show risk. Thus, a remedy may not be necessary to address some or all RAOs where such changes have occurred. Furthermore, as noted above, background levels are not well defined based on the RI dataset and need to be updated and re-assessed to develop more robust background values. Because many of the COCs have PRGs based on or very close to background levels, as currently defined, an improved understanding background conditions is key to a successful remedy. Otherwise,

predicted risk reductions, which are already minimal, will not be realized. The potential outcome is a high cost remedy which provides no public benefit.

Section 2.2 of the FS only states: "Achieving the above RAOs relies on remedial alternatives' ability to meet final remediation goals/cleanup levels derived from PRGs. At this point, Table 2.2-1a-d provides PRGs that are based on such factors as risk, ARARs, and background. Section 2.2 of the FS also states "PRGs may be further modified through the evaluation of alternatives and the remedy selection process. Final cleanup levels will be selected in the Record of Decision." Yet, there is no other mention of the process in the FS.

EPA should modify the FS to clearly describe data gaps and uncertainties that can be addressed during design, including listing anticipated pre-design and design studies, developing robust background values and using any new measured data, and the process for modifying PRGs and remedies based on these studies.

EPA Position:

Within the main text of the 2016 FS there are 26 instances where collection of additional data to assist remedy design and flexibility in refining the remedy during the remedial design process is discussed. EPA is not aware of a prescriptive number of how many instances this must be mentioned before it may be considered sufficient. The data gaps and uncertainties that can be addressed during design, including anticipated pre-design studies, is appropriately discussed in the ROD, not in the FS. [See EPA's *A Guide To Preparing Superfund Proposed Plans, Records Of Decision, And Other Remedy Selection Decision Documents* (OSWER 9200.1-23P), *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (OSWER Directive 9355.3-01), and *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (OSWER 9355.0-85)] Thus, modifications to the FS to incorporate this information are not appropriate.

LSS Dispute Issue 20 - Evaluation of MNR

The Monitored Natural Recovery (MNR) evaluation is insufficient to support the alternatives evaluation. The FS continues to omit key components of an MNR evaluation as required by guidance (such as EPA's 2005 sediment remediation guidance) including: 1) an adequate CSM; 2) appropriate evaluation of multiple lines of empirical evidence; and 3) a quantitative evaluation of natural recovery and the associated long-term (i.e., after "time zero") outcomes of the alternatives. New concerns with this FS include:

• EPA added new information on bathymetry changes and fish tissue. In Section 3.6.1.3, EPA's updated evaluation of fish tissue concentrations over time completely ignores 2012 data without any explanation.

• EPA states that, "Therefore, a minimum deposition rate of 2.5 cm/year was assumed as the criteria [sic] for effective MNR." This criterion is obviously not used by EPA in the FS because the FS assumes MNR as the applicable technology for all areas outside SMAs (as opposed to applying MNR in just areas exceeding the minimum deposition rate). Although we agree with the wide application of MNR, EPA's explanation of its MNR evaluation process is full of inconsistencies and errors.

• Rather than assuming an effective conceptual framework that will incorporate new information and adjust the assignment of MNR to specific areas during design, the FS focuses on minor challenges affecting one, of multiple, lines of evidence used to assess natural recovery rates (i.e. EPA emphasizes the challenge in assessing deposition rates for the shallow region using bathymetric data - given an assumed inability for survey boats to maneuver and obtain quality data.) In its biased presentation of this matter, EPA ignores multiple lines of evidence that can, and should, be used to reduce uncertainties during design and be used to refine technology assignments.

EPA Position:
The Respondent does not provide any information as to why the CSM described in the RI Report produced by the LWG is inadequate. EPA significantly modified and approved the RI Report that meets the requirements of the NCP and EPA guidance and policy. Also, as stated in Section 3.6.1.3 of the 2016 FS, EPA did use the 2012 fish data in evaluating MNR. As stated in the 2016 FS, MNR is both deposition and dispersion; thus, MNR is applied to all low concentration areas, not just areas exhibiting a certain deposition rate. EPA looked at areas of deposition (see Appendix D8) to determine if enough deposition would occur in various areas of the Site using the deposition rates for each 10 ft x 10 ft pixel to mix and reduce remaining sediment concentrations to acceptable concentrations. As stated above, the 2016 FS developed alternatives based on currently available information and does not discuss what should be in a ROD for future evaluation.

IV. UPRR DISPUTE STATEMENT RESPONSE

UPRR Dispute Issue 1 – Overarching Concern

Under the Comprehensive Environmental Response Compensation and Liability Act ("CERCLA"), 42 U.S.C. § 9601 et seq., and its implementing regulation, the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), 40 C.F.R. Part 300, EPA is required to use a specified framework and particular criteria for identifying and evaluating cleanup alternatives to address unacceptable risks posed by hazardous substances. EPA's national sediment guidance documents explain how the NCP framework should be utilized at sediment megasites.

While EPA has substantial discretion in how it evaluates cleanup alternatives and identifies a preferred alternative using the nine criteria for FS evaluations set forth in 40 C.F.R. § 300.430(e), the cleanup goals must be achievable through the implementation of the selected cleanup. Contaminated Sediment Remediation for Hazardous Waste Sites, December 2005 ("Sediment Guidance').

Such is not the outcome of the FS for the Site. In failing to comply with requirements for evaluating cleanup alternatives in a FS, as described in more detail below, EPA Region 10 has generated a preferred alternative that requires attainment of a total PCB cleanup goal that is not achievable and sustainable, is far more disruptive than described by EPA, will take much longer to implement than predicted by EPA, will likely cost significantly more than estimated by EPA, and is therefore not cost-effective as required by the NCP. Further, the FS does not identify which areas currently pose the highest risk and should be prioritized for remediation.

This result is inconsistent with one of the fundamental principles of the Superfund program as expressed in the NCP Preamble: " ... this process [the remedy selection process] considers the full range of factors pertinent to remedy selection and provides the flexibility necessary to ensure that remedial actions selected are sensible, reliable solutions for identified site problems." 55 FR 8700 (March 8, 1990).

The LWG's draft FS fulfilled the requirements of the law and EPA guidance, proposing a workable, common sense cleanup. EPA's unnecessary and inappropriate takeover of the FS from the LWG has diminished the quality and value of the FS. The LWG's 2012 draft FS incorporated reliable science, provided the required comparative analysis of alternatives, and relied on realistic estimates of cost and time necessary to perform work. The LWG was prepared to fully engage with EPA and resolve EPA's comments and concerns in order to produce a report that provided a credible basis for EPA's selection of a remedy that conformed to CERCLA, the NCP, and EPA guidance. EPA's unwarranted deviation from the RI/FS process agreed to by EPA in 2001 was an abuse of discretion and will not lead to an effective and timely cleanup.

Cleanup projects that are estimated to cost hundreds of millions, if not billions, of dollars must be evaluated and selected based on how effectively they will perform in the physical world. At *this Site in particular, the impact of fast-flowing river dynamics on the schedule and cost of remediation are not sufficiently evaluated in the FS.*

Union Pacific disputes the FS as a whole because it leads to a proposed cleanup project that has not been sufficiently evaluated as required under the NCP and has no realistic chance of being implemented as described by EPA. Union Pacific also disputes the determination that certain sediments in the vicinity of its railyard (the "Albina Yard") require remediation. Further specific bases for Union Pacific's dispute of the FS are set forth in the paragraphs below.

EPA Position:

See EPA's position to LWG's requested relief #2.

UPRR Dispute Issue 2 - EPA's PCB Cleanup Goal is Not Achievable

The preliminary remediation goal ("PRG") for total PCBs in the FS is nine parts per billion ("ppb"). The basis for this value is that it is the "background" value determined by EPA in the Rl. The cleanup goal for PCBs is highly significant because PCBs are driving over 90 percent of the risk at the Site.

Union Pacific disputes both that the background number is achievable at the Site and that it should be used as a cleanup goal. Neither CERCLA nor the NCP authorizes EPA to select cleanup goals that are not achievable. EPA's guidance states the FS should confirm that cleanup goals are achievable by the sediment cleanup itself. Sediment Guidance, page 2-15.

In section 7.2.2 of the Rl, the upriver reach of the lower Willamette River extending from RM 15.3 to 28.4 was selected as the reference area for determining PCB background sediment concentrations. Although separated from the Site by anywhere from four to 17 miles, EPA chose this area because it is considered broadly representative of the upstream sediment loading to Portland Harbor. Based on its evaluation of data from this reference area, EPA determined the background concentration for PCBs for the Site is nine ppb.

The Lower Willamette Group disputed how EPA evaluated the data in determining background. In his letter dated March 24, 2015, denying the dispute, Richard Albright, the then current Director of the Superfund program in Region 10, wrote at page 16:

I would like to emphasize that as noted by EPA's Response at p. 24, there are sources of contamination outside of the Site - both upriver of the Site and within the downtown reach - that may affect the ability of the cleanup efforts within the Site to equilibrate to the selected cleanup level regardless of whether the cleanup level is based on risk, regulatory standard or background. In this regard, the Site is similar to other urban sediment sites which CERCLA addresses like the Lower Duwamish Site in Seattle.

If the Site cannot "equilibrate" to nine ppb, the cleanup level will not be achieved by the sediment cleanup action. The LWG submitted comments to EPA explaining how equilibrium, not *background, should be used to establish PRGs and evaluate FS alternatives. The final FS appears to disregard all of this information.*

Perhaps the most reliable certainty at the Site is that the Lower Willamette River continuously flows in one direction, from south to north, without pause or deviation. As part of the flow, the river carries sediments, much of which are deposited within the Site. Equilibrium is the result, in part, of concentrations of contaminants in the incoming sediments from upstream. As strongly suggested by Rick Albright, active remediation within the Site cannot achieve concentrations lower than that of the equilibrium level.

The LWG estimated equilibrium concentrations based on existing Rl empirical data, including deposited surface sediment data (from depositional areas upstream of the Site and from depositional areas within the upper reaches of the Site but apart from known source areas), sediment trap data, upstream suspended sediment data, and smallmouth bass fish tissue data from 2002, 2007, and 2012. The result of the LWG's evaluation of empirical data, which was presented to EPA in August 2014, is that the equilibrium value for total PCBs should be 20 ppb. The LWG advised that EPA should not select risk-based PRGs below equilibrium values, including for PCBs. EPA's failure to do so, and failure to explain why the FS does not incorporate any evaluation of equilibrium, is inconsistent with the reasoning of its own former Director and an array of real-world data, and undermines the presumption that its proposed cleanup goal for total PCBs is realistically achievable.

Further, EPA's failure to use reliable models to reasonably predict when cleanup goals will be attained is another significant omission in the FS. In effect, EPA has not included any credible information in the FS indicating that its cleanup goals, particularly for PCBs, are actually achievable and sustainable over the long-term at the Site. The importance of models (e.g., sediment transport model and bed composition model) in making cleanup decisions at sediment sites is explained in detail in the Sediment Guidance, section 2. 9. Such models are generally used at large sediment sites (e.g., Lower Duwamish and Lower Passaic sites}, but were not used here.

Union Pacific disputes both that the cleanup goal for PCBs is achievable at the Site and that it is consistent with the NCP.

EPA Position:

While UPRR alleges that EPA chose the upriver reach from RM 15.3 to 28.4 as the “reference area,” the administrative record for this site clearly indicates that the LWG chose this area, in consultation with EPA, DEQ, and the tribes. EPA does not discount the presence of possible in-water PCB sources upstream of the current Site boundary at RM 11.8, or of potential upland sources. However, the assumption in the 2016 FS is that those sources would be controlled and DEQ has represented that it will have significant upstream sources addressed. [See DEQ’s 3/25/16 updated summary report **(AR Doc ID # 1000019892)**, Section 4.7, and their presentation to the NRRB, **(AR Doc ID 100002728)** at Slide 16.] It is EPA’s expectation that potential sources will be controlled through DEQ’s source control efforts under State authority, or if necessary by EPA using its CERCLA authority. Thus, background concentrations as represented by the deposited sediment concentrations exhibited in the “reference area” remain the best predictor of achievable cleanup goals for the Site, particularly given the unreliable nature of the predictions from the LWG's sediment fate and transport model (see 2016 FS Section 4.1.2 and Appendix H). The sediment data for Portland Harbor is replete with a large signature of PCB concentrations at or less than the PRG of 9 ppb, which would not be possible if the LWG's "equilibrium" theory were credible (Figures 5.2-1 and 5.2-2 in the final RI report). In addition, EPA notes that the assertion that "the most reliable certainty at the Site is that the Lower Willamette River continuously flows in one direction, from south to north, without pause or deviation" is not true and is directly contradicted by information presented in the LWG's own reports submitted to EPA, which clearly note that Portland Harbor is subject to tidal influence and also documents flow reversals from the Columbia River backing up the Willamette during flooding or high water events through at least the downtown reach. Lastly, UPRR overstates that EPA's sediment guidance emphasizes the "importance of models"; a more correct characterization of the guidance is that the models can be useful. However, the lack of the proper time-series data, as acknowledged in the LWG's draft 2012 FS, prevented validation of a sediment transport model for Portland Harbor.

UPRR Dispute Issue 3 - Risk Management is Absent from FS Evaluation

Another fundamental flaw in the FS is the absence of credible risk management. Risk management in the Superfund program requires the consideration of the advantages and disadvantages of cleanup alternatives and a balancing of trade-offs. This analysis includes an evaluation of the uncertainties at the Site, including uncertainties in the reliability of the exposure data used to identify the risks. 40 C.F.R. § 300.430(e)(2)(i)(A)(4). Further, as noted in the NCP Preamble, "[t]he likelihood of the exposure actually occurring should be considered when deciding the appropriate level of remediation, to the degree that this likelihood can be determined." 55 FR 8710 (March 1990).

As described in the Sediment Guidance: "A risk management process should be used to select a remedy designed to reduce the key human and ecological risks effectively." Sediment Guidance, page 7-1. It is telling that the term "risk management" is never used in the FS.

At Portland Harbor, the risk assessments, particularly for human health, are built on a cascade of conservative assumptions regarding exposure and durations. Unacceptable risks to various consumers of fish are based on questionable assumptions of how many fish people eat, from which areas of the river, how the fish are cooked, and for how many years. Contrary to the NCP, the assumptions were not placed in an overall estimate that is conservative but within a realistic range of exposure as required by the NCP. NCP Preamble, 55 FR 8710. Further, the assumptions used at Portland Harbor are not compared to assumptions used at other sediment megasites (i.e., nowhere is there an explanation why people are more exposed to certain kinds of risk in Portland than they are in Seattle or Newark, for example).

Of equal importance is that EPA's FS fails to document how the risk assumptions have been considered when evaluating alternatives. The FS describes what appear to be highly exaggerated risks at the Site. For example, the acceptable consumption rate is 6 fish meals every 10 years. EPA does not provide backup for how meals per 10 years were calculated or how it is consistent with the baseline risk assessment. Nor does EPA clarify whether resident fish caught from any location within the 10-mile river contribute to potential excess risk. In the absence of *such information in the FS, it is not apparent that the reliability of the exposure assumptions has been sufficiently considered (i.e., whether an important element of risk management has even been conducted).*

Finally, the FS does not identify which areas currently pose the highest risk and should be prioritized for remediation. At a 10-mile Site that, according to the FS, encompasses nearly 300 acres requiring active remediation and likely close to 20 years to perform the cleanup, it would seem necessary and prudent to establish a basis for prioritizing and sequencing the cleanup of the higher risk areas. EPA's failure to do so is an indication that it is not effectively managing the risk.

Union Pacific asserts EPA has failed to comply with regulations and guidance because the FS fails to document that EPA included a legitimate risk management step in its evaluation and decision-making process. The absence of risk management means EPA has not demonstrated the preferred alternative represents the most appropriate solution for the Site.

Union Pacific disputes that the FS incorporates risk management as required by the NCP.

EPA Position:
UPRR's issues with the BHHRA and the exposure assumptions used were the subject of a previous formal dispute by the LWG under the AOC. EPA's position and determination of the appropriateness of the assumptions used for the Portland Harbor Site was documented in the final ECL Director decision and supporting administrative record. **[AR Doc ID # 1432316 and 715198]**

In the 2016 FS, EPA used equations B3-15 and B3-16 to calculate fish meals and solved for the consumption rate (CR). These are the same equations used to establish risk in the BHHRA.

Lastly, regarding UPRR's assertion that the FS was not clear about how risk management was applied in evaluating the alternatives, the NCP and EPA guidance state that risk management should be used in selecting a remedy. EPA did not select a remedy in the 2016 FS; thus, did not discuss risk management in selection of a remedy. The Preferred Alternative was discussed in the Proposed Plan and the final remedy will be selected in the ROD.

UPRR Dispute Issue 4 - The FS Requires More Sediment Removal Than Necessary
"Principal threats are characterized as waste that cannot be reliably controlled in place, such as liquids, highly mobile materials (e.g., solvents), and high concentrations of toxic compounds (e.g., several orders of magnitude above levels that allow for unrestricted use and unlimited exposure)." NCP Preamble at 55 FR 8703.

In the FS, EPA has designated large areas of sediments with relatively low concentrations as principal threat waste ("PTW") (e.g., above 200 ppb total PCBs) that must be removed from the Site, including near Union Pacific's Albina Yard. However, the FS fails to explain satisfactorily *how sediments in these large areas are highly mobile or highly toxic and how they cannot reliably be contained in place.*

The FS does not contain a credible conceptual site model that identifies the extent to which certain areas of sediments are "highly mobile" and need to be removed. Most areas of the Site are depositional, meaning that sediments in these areas are stable and likely to remain in place in the future. In many cases, where contaminant concentrations in surface sediments in these areas represent an unacceptable risk, such sediments can be reliably contained in place.

Nor are the PCB levels in the river "highly toxic". In the risk assessment, EPA identified unacceptable risks based on fish consumption, which is an indirect exposure pathway (i.e., people are not eating contaminated sediments). Consistent with acceptable risk assessment methodology, exposure assumptions were averaged over time and space to best represent potential indirect exposure to people eating fish. The exposure units for the fish consumption pathway ranged from site-wide to individual EPA river miles, depending on the home range of the fish species.

In its designation of PTW, however, the FS disregards acceptable methods for assessing indirect risk and identification of PTW thresholds. In the FS, any sediment that exceeds 200 ppb PCBs is deemed PTW. The FS does not explain or justify why sediment at such a relatively low concentration is "highly toxic" (i.e., several orders of magnitude above levels that allow for unrestricted use and unlimited exposure). At many other sediment megasites around the country, EPA's cleanup level for total PCBs is 1 part per million. Sediment containing PCBs at 200 ppb is one-fifth of what is considered an acceptable cleanup level at these other sites. The FS's designation of "highly toxic" material at Portland Harbor is without basis, contrary to policy and practice elsewhere, and clearly not reasonable.

Further, as the LWG has explained to EPA, EPA's decision to cap, rather than remove, more highly contaminated sediments associated with the McCormick-Baxter site is inconsistent with its current position on treating principal threat waste elsewhere at the Site.

Union Pacific disputes EPA's designation of principal threat waste at the Site.

EPA Position:
See EPA position to LWG dispute issue 2c.

EPA did not establish a requirement for removal of principal threat waste in the 2016 FS. Technology assignments were made in the 2016 FS based on area-specific environmental conditions discussed in Section 3 of the 2016 FS. Contaminated sediment identified as principal threat waste was only further evaluated for treatment as discussed in both the NCP and EPA guidance.

UPRR Dispute Issue 5 - The FS Substantially Underestimates the Impacts of Performing, and the Time and Cost to Perform, the Preferred Alternative
One of the key FS evaluation criteria in the NCP is short-term effectiveness, which requires consideration of the effects of the alternative during the construction and implementation phase

until remedial response objectives are met. 40 C.F.R. §300.430(e)(9)(iii)(E). At sediment sites, short-term risks associated with capping and dredging may include potential contaminant releases during such operations (which may increase fish tissue concentrations) as well as accidents to workers, disruptions to business and recreational uses, and other impacts to the community (e.g., from light, noise, and air emissions). Sediment Guidance, at page 7-9. At a site where the cleanup will take many years to perform, a realistic evaluation of the time to perform the cleanup also needs to be incorporated into the evaluation of short-term impacts.

The FS does not include a reasonable quantification of the above-described short-term impacts, such as realistic estimates of the extent of dredge releases (e.g., water quality impacts). For each more aggressive alternative, the FS simply says the short-term impacts will be "greater."

EPA Position:

There is nothing in EPA guidance (1998 or 2005) that requires quantification of short-term impacts. The guidance states that these impacts should be identified and the trade-off between alternatives discussed. The impacts are the same for all alternatives (except the no action alternative), the only difference is that the impacts are longer due to the increased construction duration with each alternative. Section 4.3.5 of the 2016 FS discusses the trade-offs for short-term effectiveness between alternatives. EPA states that the impacts for any alternative will be for 4 months per year and last the duration of the construction project. EPA quantified the construction period of each alternative and as the construction of the project increases, so would the impacts.

Moreover, the NCP requires not only an assessment of individual alternatives against each of the nine criteria but also "a comparative analysis that focuses upon the relative performance of each alternative against those criteria." 40 C.F.R. § 300.430(e)(9)(ii). The socalled comparative analysis in the FS is oversimplified and does not attempt to meaningfully consider the trade-offs between increasing short-term impacts and the alleged benefits of more expansive dredging and capping requirements. If, for example, the water quality impacts (and associated impacts to fish tissue concentrations) from dredging are increasingly significant as the extent of dredging and capping increases, then there should be corresponding increases in the benefits from performing such increasingly more aggressive approaches. However, the FS does not include a credible explanation of how the preferred alternative's combination of active remediation and monitored natural recovery achieves cleanup goals in a substantially shorter time than less aggressive alternatives using a different combination (i.e., more monitored natural recovery). The required balancing of trade-offs under the NCP is conspicuously absent from the FS.

EPA Position:

The comparative analysis conducted in the 2016 FS is consistent with the requirements of the NCP and EPA's guidance (cite to FS and sediment guidance). Increases in fish tissue concentrations due to dredging would only occur during the four month construction period. The increases would localized to where the dredging occurs and would be far less than the exposure during the high flow periods. Longer periods of dredging result in longer exposure in the site as a whole, as discussed in the 2016 FS, but tissue concentration would not increase because of the localized nature of the dredging and home range of the fish. Since all the alternatives include dredging in the same localized areas of the Site, the effects from dredge releases would be fairly indistinguishable between alternatives. At other sites, fish tissue concentrations have been shown to increase during dredging operations and then decrease substantially within a year of construction completion.

Respondents are referring to remedy selection criteria. A preferred alternative is not selected in the 2016 FS. The preferred alternative is discussed in the Proposed Plan, which is not subject to the dispute provisions under the AOC.

In addition, the FS is wildly optimistic about the estimated time to perform each of the alternatives. In October 2016, the Port of Portland ("Port"), which has extensive experience with dredging projects, participated in a meeting with Jim Woolford, the head of EPA's national Superfund program, and explained that EPA's estimates of construction duration and cost were not reasonable and needed to be revised. On October 13, 2015, the LWG provided Mr. Woolford a memo which incorporated the Port's analysis (Enclosure 1). The FS fails to incorporate the Port/LWG's estimates and does not explain why it disagreed with them. Based on the memo, which incorporated the Port's real-life experience with dredging projects, it is very likely that the magnitude and duration of short-term impacts associated with the cleanup are substantially underestimated in the FS.

EPA Position:
See EPA's position to LWG's dispute issue 1f.

Further, as noted in section 2 above, EPA's failure to use reliable models to predict when cleanup goals will be attained is a fundamental flaw in the FS. For example, Page ES-16 of the FS states as follows: "Alternative I achieves more interim targets than Alternative D and is therefore more reliable in achieving PRGs and RAOs in a reasonable time frame because it relies less on natural processes."

But there is no information in the FS that supports the apparent assertion that Alternative I will achieve PRGs and RAOs more quickly than Alternative D. In the absence of a reasonable basis to compare the time frames in which the cleanup goals will be attained, the trade-offs between increased short-term impacts and the long-term benefits of the cleanup cannot be made as required under the NCP.

EPA Position:
As stated in the 2016 FS, no reliable model of the lower Willamette River exists because Respondents did not collect data necessary to support development of a reliable model. If respondents wanted to use a reliable model, then they should have collected the necessary data identified in EPA guidance (2005) to support the development of a reliable model. Further, EPA's guidance does not require that a model be used, acknowledges that the use of any model in this type of system is highly unreliable in estimating recovery time frames, and only states that models are helpful in relating one alternative to another. There is no model that has the ability to

predict with any certainty that these processes will occur in precisely some time frame. Models can only be used to show how alternatives perform relative to each other.

EPA has enough information in the CSM to understand that MNR processes are occurring in the lower Willamette River. Cleaner sediments from upriver continue to move into the Site, mix with the contaminated sediment, and transport to the Columbia River and out to the ocean. There is very little area within the Site that is constantly depositional (see 2016 FS Appendix D8), thus MNR is going to happen through deposition, mixing and dispersion. Logically, if there is a lower residual concentration in an area of the Site, then it will take less deposition, mixing and dispersion, and thus, less time, to reduce the contaminated sediments concentrations in order to reach the desired remediation goals. Since each of the Alternatives A through H progressively increase in the area capped or dredged, the remaining sediment concentrations would be progressively lower, as shown in the following example:

	Alt A	Alt B	Alt C	Alt D	Alt E	Alt F	Alt G	Alt H
Acres cap/dredge	0	95	117	177	269	505	756	2,167
PCB SWAC (µg/kg)	208	74	NA	56	40	23	17	9

(values taken from 2016 FS Tables 3.8-3 and J2.3-1)

Since MNR is through dilution and the rate would be the same for all alternatives, the lower the post-construction SWAC, the faster the dilution to the desired goal would be. For example, if the dilution rate was 10 µg/kg per year, it would take 20.8 years for Alternative A to reach the goal, 7.4 years for Alternative B, 5.6 years for Alternative D, etc. However, the actual dilution rates vary greatly throughout the site and are currently unknown, so a quantification of the actual dilution rates and times cannot be quantitatively computed with any accuracy. Thus, this evaluation could only be made qualitatively.

Another significant omission in the FS is the absence of information to support the statutory determination of cost-effectiveness. As explained in the dispute letter submitted by a group of AOC signatories, significant categories of costs are either underestimated (e.g., engineering design, waste processing, water treatment, sheet pile barriers) or completely absent (e.g., pre-design investigation, agency oversight, and Oregon Department of State Lands fees for access, leases, and easements).

Second, the FS fails to examine and compare the relative magnitude of cost to effectiveness of each alternative individually and the cost and effectiveness of alternatives in relation to one another. See NCP Preamble at 55 FR 8728.

<u>EPA Position:</u>
See EPA's position to LWG's dispute issue 2b.

The LWG has submitted many comments to EPA about deficiencies in the draft FS. Most of the deficiencies remain unaddressed. Issues associated with the evaluation of shortterm effectiveness, cost, and time are among significant concerns. However, just these concerns alone *demonstrate a substantial weakness in the required evaluations in the FS and significantly impair any representation by EPA in the FS that the preferred alternative represents the best balance of the cleanup evaluation criteria.*

Union Pacific disputes that EPA's evaluation of short-term impacts, cost-effectiveness, and time for construction of the cleanup are reasonable and in accordance with the NCP.

EPA Position:
EPA considered all the issues previously raised by the LWG, and addressed all the issues raised by the LWG that needed to be addressed. Although the LWG may not agree with EPA's final decision on a particular issue does not mean that EPA did not address their issues.

UPRR Dispute Issue 6 - Sediments Near Albina Yard Do Not Require Cleanup
The FS preferred alternative identifies two areas of sediments between RM 10 and 11 that EPA has identified for cleanup, purportedly due to exceedances of the PCB remedial action level ("RAL"). EPA also identified these areas on Figure 3.2-3 as containing principal threat waste. This area of the Site is near Union Pacific's railyard at Albina Yard. Union Pacific disputes this determination, particularly the area from approximately RM 10.7 to RM 11 where there are no exceedances of the applicable RAL in surface or subsurface samples of sediments.

EPA's potential cleanup area near RM 10.7 appears to be based on a PCB exceedance in soil at one location on a 900-foot stretch of the riverbank. EPA included riverbanks as part of its draft FS evaluation of alternatives, but did not identify Albina Yard as a site with "known contaminated riverbank" in section 1.2.3.5 of the FS.

Moreover, in its Final Remedial Investigation/Source Control Measures Evaluation Report for Albina Yard dated November 2010, which was reviewed and approved by Oregon DEQ, Union Pacific determined that the riverbank near Albina Yard had a low potential for erosion because it was highly vegetated and stabilized with rock/rip rap. Because PCB concentrations in the sediments are below the applicable RAL, and the riverbank is stable, this area of sediments should not be included as a potential cleanup area. Certainly, the FS contains no explanation for this area's inclusion as a potential cleanup area, much less as an area containing principal threat waste.

Union Pacific disputes the apparent determination that sediments near RM 10.7 require remediation and, for the reasons explained in detail in section 4 above, the designation of such sediments as principal threat waste.

EPA Position:
The 2016 FS does not identify a preferred alternative. Further, EPA only developed SMAs based on extrapolations of existing sediment data that exceeded RALs, not river bank data. As Respondents point out, the river bank at Albina is not listed as contaminated. The SMA Respondent refers to is an artifact of the computer interpolation process, like many of the other small areas on the site. Because boundaries were not used in the computer interpolation process, this SMA is actually based on the high concentration sample data upstream from that location. EPA confirmed that there are not currently any samples in this cove that exceed RALs until more

instream away from the shore at the Alternative H level, which is why there is an SMA strip outside the cove. The 2016 FS is not a design document and the footprints of the SMAs are based on extrapolations of RI/FS data, not design level data, and should not be used as absolute boundaries for SMAs. They are merely to identify at this stage of the process the cost estimates of remedial technologies to be used at the site in order to conduct a comparative analysis. Sampling conducted in remedial design will determine the boundaries for SMAs for active remediation.

UPRR Dispute Conclusion

Sediment megasites like the Portland Harbor Site are extremely challenging -challenging to characterize the contamination and the dynamics of the river system, challenging to identify what are the significant risks, and challenging to evaluate alternatives to reduce such risks. Union Pacific appreciates the hard work, resources, and dedication EPA has devoted to the Site prior to and since the Site was added to the National Priorities List in 2000.

Nonetheless, Union Pacific is concerned that because EPA's FS does not comply in significant ways with regulatory requirements and guidance recommendations for sediment megasites, EPA's description of a preferred alternative is not realistic and will not achieve protection of human health and the environment for a reasonable cost and within a reasonable time frame. Union Pacific looks forward to further communication with EPA as its dispute of the FS is considered by EPA.

EPA Position:

EPA has responded to the specific issues raised by Union Pacific. The 2016 FS was developed with EPA's experts at headquarters and reflects feedback and the support provided overall on the content and analysis contained in the 2016 FS, as well as recommendations made by EPA's expert panels for CERCLA remedies and sediment sites (NRRB and CSTAG). Union Pacific has not provided any specific or credible evidence to support that the FS does not comply with the NCP and EPA guidance.

References:

CDM Smith. 2013. Arkema Offshore NAPL Evaluation Memo. June.
Oregon Fish and Wildlife Department (ODFW). 2005. Biology, Behavior, and Resources of Resident and Anadromous Fish in the Lower Willamette River. Final Report of Research, 2000-2004. Thomas A. Friesen, editor. March 2005.

Cohen, R.M., A.P. Bryda, S.T. Shaw, and C.P. Spalding. 1992. Evaluation of visual methods to Detect NAPL in Soil and Water. Ground Water Monitoring Review, 11(2), 128-136.
Curtin, L.P. Manufacture of DDT. U.S. Patent 2654790 A filed July 3, 1951 and issued October 6, 1953.

ERM-West, Inc., 2016. Corrective Action Plan, Groundwater Extraction and Treatment System, Arkema Facility Portland, ESCI #398; June 10, 2016

Feenstra, S., D.M. Mackay, and J.A. Cherry. 1991. A method for assessing residual NAPL based on organic chemical concentrations in soil samples. Ground Water Monitoring Review, 132-141.
Integral. 2003. Phase II Stage 1 & 2 In-River Groundwater and Sediment Investigation Report, Volume 1. Prepared for ATOFINA Chemicals Inc., Portland, Oregon. December.

Rose et al. 20012. Bioaccumulation of Polycyclic Aromatic Hydrocarbons in Fish and Invertebrates of Lagos Lagoon, Nigeria. Journal of Emerging Trends in Engineering and Applied Sciences (JETEAS) 3 (2): 287-296. © Scholarlink Research Institute Journals, 2012 (ISSN: 2141-7016). jeteas.scholarlinkresearch.org

USEPA. 1992a. Dense Non-Aqueous Phase Liquids – A workshop Summary. Dallas, Texas, April 16-18, 1991. EPA/600/R-92/030. R.S. Kerr Environmental Research Laboratory, Ada, Oklahoma.

USEPA. 1992b. Estimating Potential Occurrence of DNAPL at Superfund Sites. Quick Reference Fact Sheet. EPA Publication 9355, 4-07FS. R.S. Kerr Environmental Research Laboratory, Ada, Oklahoma.

ENCLOSURES

Table 2.2-2
Summary of COC Selection Process
Portland Harbor Superfund Site
Portland, Oregon

Contaminant	CAS RN	BERA	BHHRA	Identified as a COC	Rationale for Including/Eliminating
Acenaphthene	83-32-9	X		Y	Evaluate as PAH
Acenaphthylene	208-96-8	X		Y	Evaluate as PAH
Aldrin	309-00-2	X	X	Y	Human health: shellfish
Aluminum	7429-90-5	X		N	Not ecologically significant
Ammonia	7664-41-7	X		N	Ammonia only has an HQ=3 based on FPM, which does not reliably predict sediment toxicity for individual contaminants.
Anthracene	120-12-7	X		Y	Evaluate as PAH
Antimony	7440-36-0	X	X	N	Infrequent and/or anomalous detections in fish
Aroclor 1254	11097-69-1	X		N	Evaluate as PCBs
Arsenic	7440-38-2	X	X	Y	Human health: beach, sediment, water, fish/shellfish Known groundwater plumes at site.
Barium	7440-39-3	X		N	Not ecologically significant
Benzene	71-43-2	X		Y	Known groundwater plume at site.
Benzo(a)anthracene	56-55-3	X	X	Y	Human health: beach, sediment, water, fish/shellfish Evaluate as cPAH and PAH
Benzo(a)pyrene	50-32-8	X	X	Y	Human health: beach, sediment, water, fish/shellfish Evaluate as cPAH and PAH
Benzo(b)fluoranthene	205-99-2	X	X	Y	Human health: beach, sediment, water, fish/shellfish Evaluate as cPAH and PAH
Benzo(g,h,i)perylene	191-24-2	X		Y	Evaluate as PAH
Benzo(k)fluoranthene	207-08-9	X	X	Y	Human health: beach, sediment, water, fish/shellfish Evaluate as cPAH and PAH
Benzyl alcohol	100-51-6	X		N	Not ecologically significant
Beryllium	7440-41-7	X		N	Not ecologically significant
Bis(2-ethylhexyl) phthalate (BEHP)	117-81-7	X	X	Y	Human health: fish Ecologically significant contaminant
Cadmium	7440-43-9	X		Y	Ecologically significant contaminant
Carbazole	86-74-8	X		N	Not ecologically significant

Table 2.2-2
Summary of COC Selection Process
Portland Harbor Superfund Site
Portland, Oregon

Contaminant	CAS RN	BERA	BHHRA	Identified as a COC	Rationale for Including/Eliminating
Carbon disulfide	75-15-0	X		N	Not ecologically significant
Chlordane	57-74-9	X	X	Y	Human health: fish Ecologically significant contaminant
cis-Chlordane	5103-71-9	X		N	Evaluate as chlordane
Chlorobenzene	108-90-7	X		Y	Known groundwater plume extending to river and mobilizing DDx Potential NAPL
Chloroethane	75-00-3	X		N	Not ecologically significant
Chloroform	67-66-3	X		N	Not ecologically significant
Chromium	7440-47-3	X	X	Y	Human health: surface water Known groundwater plumes at site.
Chrysene	218-01-9	X	X	Y	Human health: beach, sediment, water, fish/shellfish Evaluate as cPAH and PAH
Cobalt	7440-48-4	X		N	Not ecologically significant
Copper	7440-50-8	X		Y	Ecologically significant contaminant Known groundwater plumes at site
Cyanide	57-12-5	X		Y	Ecologically significant contaminant Known groundwater plumes at site
1,2-Dichlorobenzene	95-50-1	X		N	Not ecologically significant
1,4-Dichlorobenzene	106-46-7	X		N	Not ecologically significant
DDD (2,4´- and 4,4-DDD)	72-54-8	X	X	Y	Human health: fish/shellfish Ecologically significant contaminant Evaluate also as DDx
2,4'-DDD	53-19-0	X		Y	Evaluate as DDD and DDx
4,4'-DDD	72-54-8	X		Y	Evaluate as DDD and DDx
DDE (2,4- and 4,4-DDE)	72-55-9	X	X	Y	Human Health: fish/shellfish Ecologically significant contaminant Evaluate also as DDx
4,4'-DDE	72-55-9	X		Y	Evaluate as sum DDE and DDx
DDT (2,4´- and 4,4´-DDT)	50-29-3	X	X	Y	Human health: fish/shellfish Ecologically significant contaminant Evaluate also as DDx
4,4'-DDT	50-29-3	X		Y	Evaluate as DDT and DDx

Table 2.2-2
Summary of COC Selection Process
Portland Harbor Superfund Site
Portland, Oregon

Contaminant	CAS RN	BERA	BHHRA	Identified as a COC	Rationale for Including/Eliminating
Dibenz(a,h)anthracene	53-70-3	X	X	Y	Human health: beach, sediment, water, fish/shellfish Evaluate as cPAH and PAH
Dibenzofuran	132-64-9	X		N	Not ecologically significant
1,1-Dichloroethene (1,1-DCE)	75-35-4	X		Y	PCE/TCE plumes identified at site. DCE is a breakdown product of PCE/TCE.
cis-1,2-Dichloroethene (cis-1,2-DCE)	107-06-2	X		Y	PCE/TCE plumes identified at site. DCE is a breakdown product of PCE/TCE.
Dieldrin	60-57-1	X	X	Y	Human health: fish/shellfish Ecologically significant contaminant
Di-n-butyl phthalate	84-74-2	X		N	Not ecologically significant
2,4-Dichlorophenoxyacetic acid (2,4-D)	94-75-7			Y	Known groundwater plume
Endosulfan	115-29-7	X		N	Not ecologically significant
Endrin	72-20-8	X		N	Not ecologically significant
Endrin ketone	53494-70-5	X		N	Not ecologically significant
Ethylbenzene	100-41-4	X		Y	Ecologically significant contaminant Known groundwater plumes at site
Fluoranthene	206-44-0	X		Y	Evaluate as PAH
Fluorene	7782-41-4	X		Y	Evaluate as PAH
Heptachlor epoxide	1024-57-3	X		N	Not ecologically significant
Hexachlorobenzene	118-74-1		X	Y	Human health: fish
beta-Hexachlorocyclohexane (β-BHC)	319-85-7	X		N	beta-Hexachlorocyclohexane only has an HQ=1.9 based on FPM, which does not reliably predict sediment toxicity for individual contaminants.
delta-Hexachlorocyclohexane (δ-BHC)	608-73-1	X		N	Not ecologically significant
gamma-Hexachlorocyclohexane (γ-BHC, or Lindane)	58-89-9	X		Y	Ecologically significant contaminant
1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-HxCDF)	70648-26-9			Y	Dioxin/Furan congener contributing most to 2,3,7,8-TCDD risk
Indeno(1,2,3-c,d)pyrene	193-39-5	X	X	Y	Human health: beach, sediment, water, fish/shellfish Evaluate as PAH
Iron	7439-89-6	X		N	Not a hazardous substance
Isopropylbenzene	98-82-8	X		N	Not a hazardous substance

Table 2.2-2
Summary of COC Selection Process
Portland Harbor Superfund Site
Portland, Oregon

Contaminant	CAS RN	BERA	BHHRA	Identified as a COC	Rationale for Including/Eliminating
Lead	7439-92-1	X	X	Y	Human health: Infrequent and/or anomalous detections in fish Ecologically significant contaminant. Eliminated for dietary pathway due to infrequent and/or anomalous detections in fish.
Magnesium	7439-95-4	X		N	Not ecologically significant
Manganese	7439-96-5	X		Y	Ecologically significant contaminant Known groundwater plumes at site
Methylchlorophenoxypropionic acid (MCPP)	7085-19-0		X	Y	Human health: surface water
Mercury	7439-97-6	X	X	Y	Human health: fish tissue Ecologically significant contaminant
2-Methylnaphthalene	91-57-6	X		Y	Evaluate as PAH
4-Methylphenol (p-Cresol)	106-44-5	X		N	Not ecologically significant
Monobutyltin		X		N	Not a hazardous substance
Naphthalene	118-96-7	X		Y	Evaluate as PAH
Nickel	7440-02-0	X		N	
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-PeCDD)	40321-76-4			Y	Dioxin/Furan congener contributing most to 2,3,7,8-TCDD risk
2,3,4,7,8-Pentachlorodibenzofuran (2,3,4,7,8-PeCDF)	57117-31-4			Y	Dioxin/Furan congener contributing most to 2,3,7,8-TCDD risk
Pentachlorophenol	87-86-5		X	Y	Human health: shellfish Known groundwater plumes
Perchlorate	14797-73-0	X		Y	Ecologically significant contaminant
Phenanthrene	85-01-8	X		Y	Evaluate as PAH
Phenol	108-95-2	X		N	Not ecologically significant
Polybrominated diphenyl ethers (PBDE)	67774-32-7		X	Y	Human health: fish
Polychlorinated Biphenyls (PCBs)	1336-36-3	X	X	Y	Human health: sediment, fish/shellfish Ecologically significant contaminant.
Polycyclic Aromatic Hydrocarbons (PAHs)	130498-29-2	X	X	Y	Human health: beach, sediment, water, fish/shellfish Ecologically significant contaminant
Potassium	7440-09-7	X		N	Not ecologically significant
Pyrene	129-00-0	X		Y	Evaluate as PAH
Silver	7440-22-4	X		N	Not ecologically significant

Table 2.2-2
Summary of COC Selection Process
Portland Harbor Superfund Site
Portland, Oregon

Contaminant	CAS RN	BERA	BHHRA	Identified as a COC	Rationale for Including/Eliminating
Sodium	7440-23-5	X		N	Not ecologically significant
Sulfide	18496-25-8	X		N	Not ecologically significant
2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF)	51207-31-9			Y	Dioxin/Furan congener contributing most to 2,3,7,8-TCDD risk
2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)	1746-01-6	X	X	Y	Human health: sediment, fish/shellfish Ecologically significant contaminant
Tetrachloroethene (PCE)	127-18-4			Y	PCE plumes identified at site
Toluene	108-88-3	X		Y	Known groundwater plume at site
Total Petroleum Hydrocarbons (TPH) C10-C12 Aliphatic		X		Y	Not a hazardous substance; co-mingled with other hazardous substances Ecologically significant contaminant Known TPH plumes at site
Total Petroleum Hydrocarbons (TPH) C4 - C6 Aliphatic		X		N	Not a hazardous substance; co-mingled with other hazardous substances
Total Petroleum Hydrocarbons (TPH) C6 - C8 Aliphatic		X		N	Not a hazardous substance; co-mingled with other hazardous substances
Total Petroleum Hydrocarbons (TPH) C8 - C10 Aromatic		X		N	Not a hazardous substance; co-mingled with other hazardous substances
Total Petroleum Hydrocarbons (TPH), diesel range		X		N	Not a hazardous substance; co-mingled with other hazardous substances
Total Petroleum Hydrocarbons (TPH), gasoline-range		X		N	Not a hazardous substance; co-mingled with other hazardous substances
Total Petroleum Hydrocarbons (TPH), residual-range		X		N	Not a hazardous substance; co-mingled with other hazardous substances
Tributyltin (TBT)	688-73-3	X		Y	Ecologically significant contaminant
Trichloroethene (TCE)	79-01-6	X		Y	Known groundwater plume extending to river. Potential for others.
1,2,4-Trimethylbenzene	95-63-6	X		N	Not ecologically significant
1,3,5-Trimethylbenzene	108-67-8	X		N	Not ecologically significant
2-(2,4,5-Trichlorophenoxy)propionic acid (2,4,5-TP)	93-72-1			Y	Known groundwater plume
Vanadium	7440-62-2	X		Y	Ecologically significant contaminant
Vinyl Chloride	75-01-04			Y	PCE/TCE plumes identified at site. Vinyl chloride is a breakdown product of PCE/TCE.

Table 2.2-2
Summary of COC Selection Process
Portland Harbor Superfund Site
Portland, Oregon

Contaminant	CAS RN	BERA	BHHRA	Identified as a COC	Rationale for Including/Eliminating
m-Xylene	108-38-3	X		N	Not ecologically significant
o-Xylene	95-47-6	X		N	Not ecologically significant
p-Xylene	106-42-3	X		N	Not ecologically significant
Xylenes	1330-20-7	X		Y	Known groundwater plume at site
Zinc	7440-66-6	X		Y	Ecologically significant contaminant Known groundwater plumes at site

Table 2.2-3a
Basis for Portland Harbor COC Selection by RAO and Media
Portland Harbor Superfund Site
Portland, Oregon

	HUMAN HEALTH					
	RAO 1		RAO 2		RAO 3	RAO 4
	Human Health Ingestion/Direct Contact		Human Health Fish/Shellfish Consumption		Human Health Protected Water Uses	Human Health Migration of Contaminated Groundwater
Contaminant	Beach	Sediment	Tissue	Sediment	Surface Water	Groundwater
Aldrin			R	R	R	
Arsenic	R	R	R	R	R	A
Benzene						A
BEHP			R	R	R	
Cadmium						
Chlordane			R	R	R	
Chlorobenzene						A
Chromium					R	A
Copper						A
Cyanide						A
DDx			R	R		
DDD (2,4- and 4,4-DDD)					R	R
4,4'-DDD					R	A
DDE (2,4- and 4,4-DDE)						A
4,4'-DDE					R	A
DDT (2,4- and 4,4-DDT)					R	R
4,4'-DDT					R	A
1,1-DCE						A
cis-1,2-DCE						A
Dieldrin			R	R		
2,4-D acid						A
Ethylbenzene						A
Hexachlorobenzene			R	R	R	
Lindane						
Lead						
Manganese						R
MCPP					R	
Mercury			R	R		
Pentachlorophenol			R	R	R	A
Perchlorate						A
PBDE			R	R		
PCBs		R	R	R	R	

Table 2.2-3b
Basis for Portland Harbor COC Selection by RAO and Media
Portland Harbor Superfund Site
Portland, Oregon

	HUMAN HEALTH					
	RAO 1		RAO 2		RAO 3	RAO 4
	Human Health Ingestion/Direct Contact		Human Health Fish/Shellfish Consumption		Human Health Protected Water Uses	Human Health Migration of Contaminated Groundwater
Contaminant	**Beach**	**Sediment**	**Tissue**	**Sediment**	**Surface Water**	**Groundwater**
PAHs	R	R	R	R	R	A
Acenaphthene						
Acenaphthylene						
Anthracene						
Benzo(a)anthracene						
Benzo(a)pyrene						
Benzo(b)fluoranthene						
Benzo(g,h,i)perylene						
Benzo(k)fluoranthene						
Chrysene						
Dibenz(a,h)anthracene						
Fluoranthene						
Fluorene						
Indeno(1,2,3-c,d)pyrene						
2-Methylnaphthalene						
Naphthalene						
Phenanthrene						
Pyrene						
2,3,7,8-TCDD Eq		R			R	
1,2,3,4,7,8-HxCDF			R	R		
1,2,3,7,8-PeCDD			R	R		
2,3,4,7,8-PeCDF			R	R		
2,3,7,8-TCDD			R	R		
2,3,7,8-TCDF			R	R		
PCE						A
Toluene						A
TPH diesel (C10-C12 Aliphatic)						
TBT						
TCE						A
2,4,5-TP acid						A
Vanadium						
Vinyl Chloride						A
Xylenes						A
Zinc						

Notes:
R - Conclusion from Baseline Risk Assessment
A - ARAR

PORTLAND HARBOR RI/FS

APPENDIX I

SURFACE WEIGHTED AVERAGE CONCENTRATION UNCERTAINTY ANALYSIS (PCBS, TOTAL PAHS, DDX)

FEASIBILITY STUDY

June 2016

This page left blank intentionally.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I1. INTRODUCTION

An evaluation of the uncertainties in predicted post-construction surface sediment COC concentrations was conducted, consistent with the recommendation provided the joint National Remedy Review Board/Contaminated Sediments Technical Advisory Group Comments on the proposed remedy (EPA 2015).

Because predictions of post-construction SWACs are based on a sample from the population of contaminated sediments, statistical uncertainties are unavoidable. In addition, because most remedial investigation data are based on a mixture of sampling designs, some of which are spatially biased accurate estimates of spatial averages must generally be based on weighted averages which are intended to counter the effects of spatially biased sampling designs. In geostatistics this is referred to as de-clustering the data (Isaaks and Srivastava, 2005).

The Portland Harbor FS, data were declustered by first interpolating the concentrations to a 10-foot by 10-foot regularly spaced grid, followed by averaging the values on these grid nodes. This approach based on natural neighbor interpolation has been found to preform reasonably well for reducing bias in SWAC estimates when they are based on a combination of biased and unbiased sampling designs (Kern et al. 2009). The natural neighbor interpolation was also used as a basis to forecast performance of a range of remedial alternatives based on actions taken in areas with the highest interpolated concentrations—referred to as hill-topping. This report documents an evaluation of the uncertainty in these predictions of remedial effectiveness using nonparametric geostatistical procedure known as conditional simulation using the P-field method (Srivastava, 2005).

I2. METHODS

I2.1 DECLUSTERING METHOD SENSITIVITY

Prior to conducting the conditional simulation analysis, four declustering techniques were tested to gain an understanding of the sensitivity of SWAC estimates to declustering methods. Methods that were tested included; 1) Thiessen polygons, 2) polygonal declustering, 3) stratified sampling based methods and 4) natural neighbor interpolation.

I2.2 FUTURE CONDITION

Uncertainty in predicted future condition was evaluated using two approaches; 1) considering basic mathematical constraints relating percentage area remediated, percentage reduction in SWAC and the ratio of remediated to unremediated areas, and 2) using a spatial Monte-Carlo approach to directly estimate confidence limits on post remedial SWAC under a range of remedial action limits (RALs). The first approach is a diagnostic providing a relative understanding of the demands that may be placed on the resolution of the delineation of deposits relative to experiences at other Superfund Mega Sites. The second approach provides a more direct evaluation of the expected remedial performance, under the combination of existing circumstances, including deposit complexity and level of sampling resolution.

I2.2.1 Mathematical Constraints on Remedial Alternatives

Future condition under selected alternative scenarios was evaluated by considering basic mathematical constraints on the relationships between proportion reduction in post remedial SWAC, the percentage of area remediated, and the ratio of concentrations in remediated to unremediated areas. The constraints are based on equations in **Figure I-1** and provide remedial managers with a relative understanding of the potential level of resolution necessary to achieve remedial targets. In particular, when the remedial footprint is small and the targeted reduction in concentration is large, the ratio of average concentration in remediated areas must be much greater than that in un-remediated areas. This will be feasible, only when high concentration deposits are well-consolidated and easily delineated, or with high density sampling providing highly resolved delineation of otherwise unconsolidated complex depositional patterns.

I2.2.2 Conditional Simulation

Conditional simulation is a computer intensive resampling method analogous to bootstrap resampling, with the added constraint that rather than randomly selecting individual sample values, whole concentration maps are randomly selected and analyzed (**Figure I-2**). These maps can be thought of as a deck of cards, each of which interpolates the sample data and is also consistent with the spatial variation observed in the sample. The analysis proceeds by randomly selecting one of many equally likely maps to which proposed remedial strategies are applied. The results for each randomly selected map are summarized, providing a means to propagate spatial variation and uncertainty through complex calculations, linking uncertainty in maps with uncertainty in SWAC predictions.

The technique takes into account the spatial uncertainty in mapped surfaces, and is spatially scalable and also accounts for uncertainty in the delineation boundaries. Uncertainty calculations help to quantify the effects of the situation where some contaminant concentrations within the RAL footprint are less than the RAL, as well as the when some concentrations outside the footprint may be greater than the RAL. These types of errors are assumed negligible when forecasts are based purely on a single smooth surface which can lead to inaccurate evaluations, usually biased toward overstatement of remedial benefit. This analysis provides an assessment of how these uncertainties accumulate in the post remedial SWAC predictions.

Detailed P-Field Simulation Procedure (Optional Reading)
The P-field simulation method involves three primary steps; 1) defining conditional cumulative distributions for COCs at each 10 by 10 foot grid cell, 2) simulating a spatially correlated normally distributed random variable for each grid cell, and 3) transforming the normally distributed variable to the original COC scale by identifying the percentile of the COC distribution with corresponding percentile of the simulated normal random variable at each grid cell. The cumulative distributions represent narrower ranges near sample values and wider ranges far from sample values, causing the simulated surfaces to match measured values at the sampled locations, whereas they may vary relatively widely in areas that are distant from sampled locations.

The conditional cumulative distribution functions were estimated using a nonparametric approach based on natural neighbor interpolation approximating the indicator kriging method that is typically used to estimate cumulative distribution functions. Estimating conditional distributions requires interpolation of a range of binary (0 or 1) indicators defined based on COC concentrations being above or below a range of threshold values of interest. In this analysis threshold values were chosen to represent percentiles of the COC distributions, (1, 2.5, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 95, 97.5 and 99). For each percentile, the sample data were coded as 1 for values below threshold and 0 for values above threshold, and these binary values were interpolated using natural neighbor interpolation. This process was repeated for each of the 15 threshold values, resulting in 15 interpolated surfaces representing the probability that COC concentrations were less than the threshold value. This series of 15 probability values unique to each grid cell is an estimate of the conditional cumulative distribution at that location. Traditionally this interpolation is conducted using indicator kriging. However, using natural neighbor interpolation has two distinct advantages, there is no need to model 15 sets of directional indicator variograms necessary for kriging,, and the natural neighbor method does not require any assumptions of stationarity as is assumed for kriging. Effectively by using the natural neighbor method to interpolate the indicator data, the resulting simulation is both non-parametric as well as accommodating spatially nonstationary COC distributions.

I3. RESULTS

I3.1 DECLUSTERING METHOD SENSITIVITY

Estimated SWACs for PCBs based on four declustering methods ranged from 79 µg/kg for the method stratified on RAL areas, to 205 µg/kg based on unweighted averages within geographic strata. The geographic areas used in this analysis are presented on **Figure I-9**. The stratified method based on Thiessen Polygon weighting was 135 µg/kg, and the method stratified based on RAL areas and using Thiessen Polygon weighting was similar to the natural neighbor method deployed in the FS. As shown, the effects of biased sampling are substantial, with higher unweighted estimates reflecting tendency to focus sampling on high concentration areas. This indicates that some form of declustering is appropriate to improve the accuracy of estimates which would otherwise be based on an unweighted average.

I3.2 MATHEMATICAL CONSTRAINTS

The planned percentage SWAC reduction was plotted against percentage area remediated for PCBs to evaluate the susceptibility of remedial alternatives identified in the FS to delineation errors, and to compare with other remedial alternatives implemented at a number other Superfund Sites (**Figure I-3**). Alternatives E and G each require that the ratio of average SWAC within remediated to unremediated areas should be approximately a 10 to 1 ratio—both alternatives falling roughly along the red 10 to 1 curve. Other sites that have deployed similar ratios, include the Fox River OU4-5 and River Section 2 of the Hudson River. The results at the Fox River Site are not yet complete; however, the deposits there were relatively broadly distributed and only mildly consolidated and ultimately substantial design sampling has been required to achieve this goal. Conversely, deposits in River Section 2 of the Hudson River Site are better consolidated, but not as well consolidated as is apparent in Portland Harbor, and the desired outcome was not fully achieved there. Based on qualitative observation of the distribution of surface COCs at Portland Harbor, it is anticipated that this 10 to 1 ratio is likely to be achievable with substantially less resolution than was required at the Fox River Site, and potentially similar sampling densities to those deployed at the Hudson River in River Section 2. The conditional simulation will help to test this observation more rigorously.

I3.3 CONDITIONAL SIMULATION

Conditional simulation was used to estimate uncertainty in the SWAC vs RAL relationship. The RAL was varied for each COC representing remedial action limits associated with alternatives B through G described in the FS (**Table I-2**). The lateral footprint for each RAL was defined by all grid cells with natural neighbor interpolated concentrations exceeding each specified RAL.

To simulate remediation, remediated cells were replaced with expected background concentrations and SWAC was calculated by averaging all cells (remediated and un-remediated) in the map

Four equally likely simulated maps of PCB concentration are shown in **Figure I-4** to illustrate the level of variation that may occur between maps, but that is nonetheless consistent with the sample data. The RAL boundaries for Alternative E, established from the smooth natural neighbor interpolation, are overlaid so that it can be seen that for some maps, areas outside the remedial footprint exceed the 200 µg/kg threshold and that in some areas for some maps concentrations inside the remedial footprint may be less than the RAL. Generally areas within the RAL footprints tend to be similar among all four maps; however, some areas outside the footprint tend to vary substantially, as indicated by the callouts in the left two panels. This reflects the greater sampling density within the deposits relative to somewhat lower sampling density within the navigation channel, where concentrations are lower and inaccuracies in delineation have less effect on remedial effectiveness.

Conditionally simulated SWACs for PCB concentrations varied from approximately 67 to 95 with an average of 79 prior to remediation, which was equal to the SWAC estimated from the average of the natural neighbor surface (**Figure I-5**). These values were equal because the simulation algorithm is intentionally constrained so that the synthetic mean is required to match the declustered SWAC based directly on sample data.

This range is also portrayed on **Figure I-6**, depicted as a gray band surrounding the pre-remedial SWAC estimate. The simulated SWAC distribution, depicted as red squares with error bars shows that as expected SWAC declines with lower RALs. Additionally, the uncertainty bounds on SWAC is narrower for lower RAL values reflecting that a larger remedial footprint both reduces the SWAC but also its uncertainty. Action limits of 750 µg/kg and 1,000 µg/kg had higher uncertainties, with remedial benefit potentially within the margin of error, as indicated by the overlapping uncertainty bounds with the pre-remedial SWAC. Post remedial SWAC for total PCB is clearly outside the margin of error of pre-remedial SWAC indicating clear expectations that the predicted remedial benefit is likely to be achieved in practice.

Pre and post remedial total PAH and DDx concentrations in relation to action limits are plotted on **Figure I-7** and **Figure I-8** respectively. These distributions are characterized by similar qualitative patterns to those observed for PCBs. Relative error is generally greater for these COCs than for PCBs which had greater skewedness in the PAH and DDx distributions, relative to the PCB distribution. Notably, the effects of this uncertainty are minimized in the post remedial forecasts where these areas are remediated under any RAL considered, and therefore their influence is eliminated from the analysis. These RAL and corresponding SWAC values are also summarized in **Table I-3**.

I4. DISCUSSION

Surface weighted average concentration is an estimate exposure to receptors which may range over large areas. If sampling were purely unbiased, standard estimation methods for the mean and its confidence interval would be appropriate and less computationally complex. Because the sample data are right skewed, nonparametric, as opposed to normal theory, methods are preferred irrespective of the sampling design. If the sampling design had been unbiased, one could select one of the bootstrap based methods provided in ProUCL for estimating the mean and it is UCL. However, with biased sampling prevalent at Portland Harbor it is necessary to spatially weight the data in order reduce bias in the estimated mean and to properly characterize uncertainty bounds. Conditional simulation, is a variant of bootstrapping for designed to accommodate biased sampling designs and data that are spatially correlated.

The gray band on **Figures I-6** through **I-8** represents the 95 percent confidence interval for the pre-remedial SWAC, and the error bars represent 95 percent prediction intervals for the post remedial SWAC corresponding to each RAL. When these intervals do not overlap, one can be more than 95 percent confident that the pre and post remedial means would differ ($p<0.05$). When one error bar overlaps the mean there is no difference at the 5 percent level of confidence ($p>0.05$) and when error bars overlap slightly, one can conclude that there are differences but that the confidence level may be somewhat less than 95 percent. Generally, any RAL which results in an estimated SWAC with error bars that do not overlap the confidence limits of the pre-remedial SWAC can be expected to reliably result in reduced post-remedial concentrations within the range of values bounded by the confidence limits.

It should also be noted that as the RAL declines, the error bars also decline. This is because the variance the change in SWAC is proportional to the square of the proportion of area remediated.

$$var(\Delta SWAC) = (Proportion\ Remediated)^2 \times var(\Delta Concentration)$$

Simply, as the size of the remedial footprint grows, the chance of making delineation mistakes declines with the area remediated. If the entire site is remediated, there is no uncertainty.

I5. REFERENCES

EPA, 2015. National Remedy Review Board and Contaminated Sediments Technical Advisory Group Recommendations for the Portland Harbor Superfund Site. Office of Solid Waste and Emergency Response. December 31, 2015

Isaaks, E. and R.M. Srivastava. 2005. *Introduction to Geostatistics*, Oxford University Press. New York.

Kern, J.W. 2009. Geostatistical conditional simulation for incorporating uncertainty into SWAC-based remedial selection. Fifth international conference on remediation of contaminated sediments. Jacksonville, FL.. https://www.researchgate.net/publication/236585034_Geostatistical_Conditional_Simulation_for_Incorporating_Uncertainty_into_SWAC_Based_Remedy_Selection. Last accessed 4/14/2016.

Srivastava, R.M. 2005. Probability field simulation: A retrospective. In: *Geostatistics Banff, 2004., 55-64.* Springer, Netherlands.

Tables

This page left blank intentionally.

Table I-1
Declustering Method Sensitivity for PCBs
Portland Harbor Superfund Site
Portland, Oregon

Declustering Method	SWAC Estimates PCBs (µg/kg)
Stratified and Unweighted	205
Stratified on Geographic areas with Thiessen Polygons	135
Stratified on RAL Areas with Thiessen Polygons	79
Polygonal Declustering	105
Average Natural Neighbor Map	80

Table I-2
RALs for Remedial Options B through G for PCBs, Total PAH and DDx
Portland Harbor Superfund Site
Portland, Oregon

COC Name	Units	Remedial Option					
		B	C	D	E	F	G
PCBs	µg/kg	1,000	750	500	200	75	50
Total PAHs	µg/kg	170,000	130,000	69,000	35,000	13,000	5,400
DDx	µg/kg	650	550	450	300	160	40

Table I-3
Predicted Post Remedial SWAC (µg/kg) for a RALs.
Portland Harbor Superfund Site
Portland, Oregon

COC	RAL	95% Lower Confidence Limit	SWAC	95% Upper Confidence Limit
PCBs	50	22	24	25
	75	27	28	30
	100	30	32	34
	200	37	42	46
	500	48	55	64
	750	53	61	72
	1,000	56	65	77
Total PAHs	5,400	2,082	2,580	3,116
	13,000	2,899	3,882	4,845
	35,000	3,979	5,618	7,251
	69,000	4,518	6,817	9,405
	130,000	5,479	8,641	13,035
	170,000	6,054	9,539	14,980
DDx	40	13	16	19
	160	19	24	33
	300	21	28	43
	450	23	33	55
	550	23	35	64
	650	24	38	71

Figures

This page left blank intentionally.

A_U –Unremediated Area

C_U--Unremediated Concentration

A_R –Remedated Area

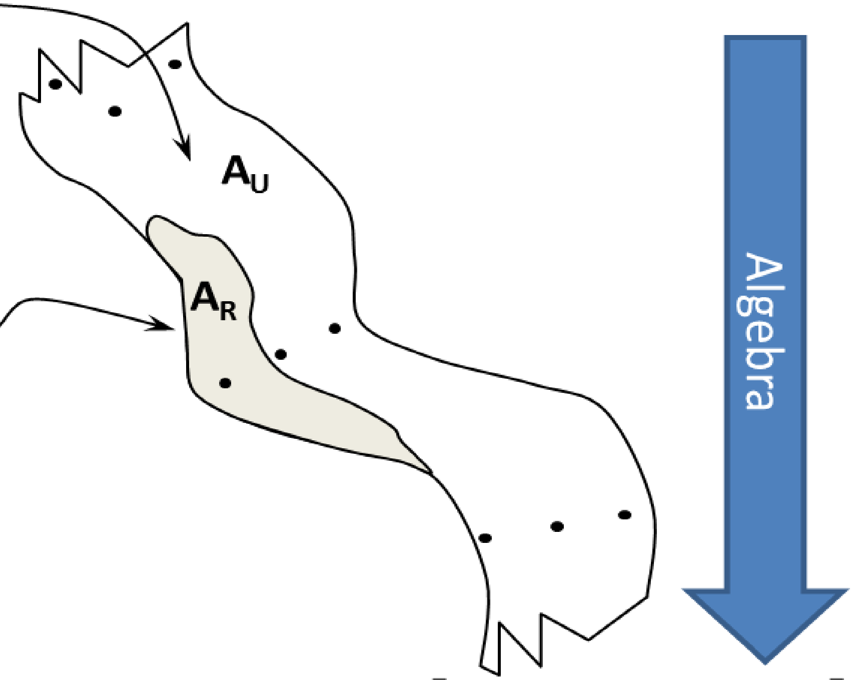
C_R-Remedial Footprint Concentration

$C_{Residual}$ -Post-remedial Concentration

$$R_A = A_R/(A_R + A_U)$$

$$R_C = C_R/C_U$$

$$SWAC = \frac{(A_U \times C_U + A_R \times C_R)}{A_U + A_R}$$



$$\frac{\Delta SWAC}{SWAC} = R_A \left[\frac{1 - \frac{C_{Residual}}{C_R}}{R_A + (1 - R_A)/R_C} \right]$$

Figure I-1. Mathematical Relationships Governing Remedial Performance

This page left blank intentionally.

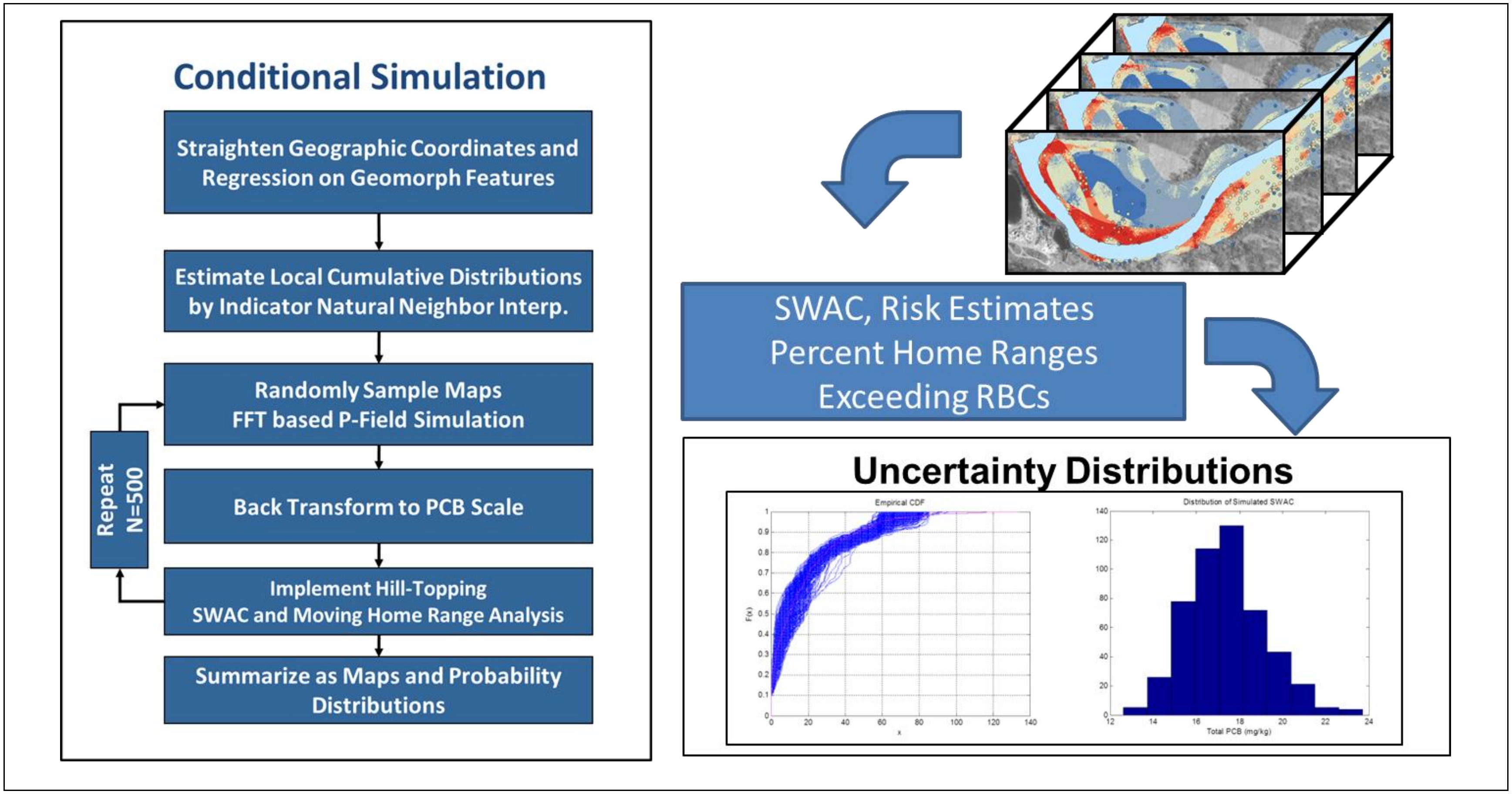


Figure I-2. Conditional Simulation Procedure

This page left blank intentionally.

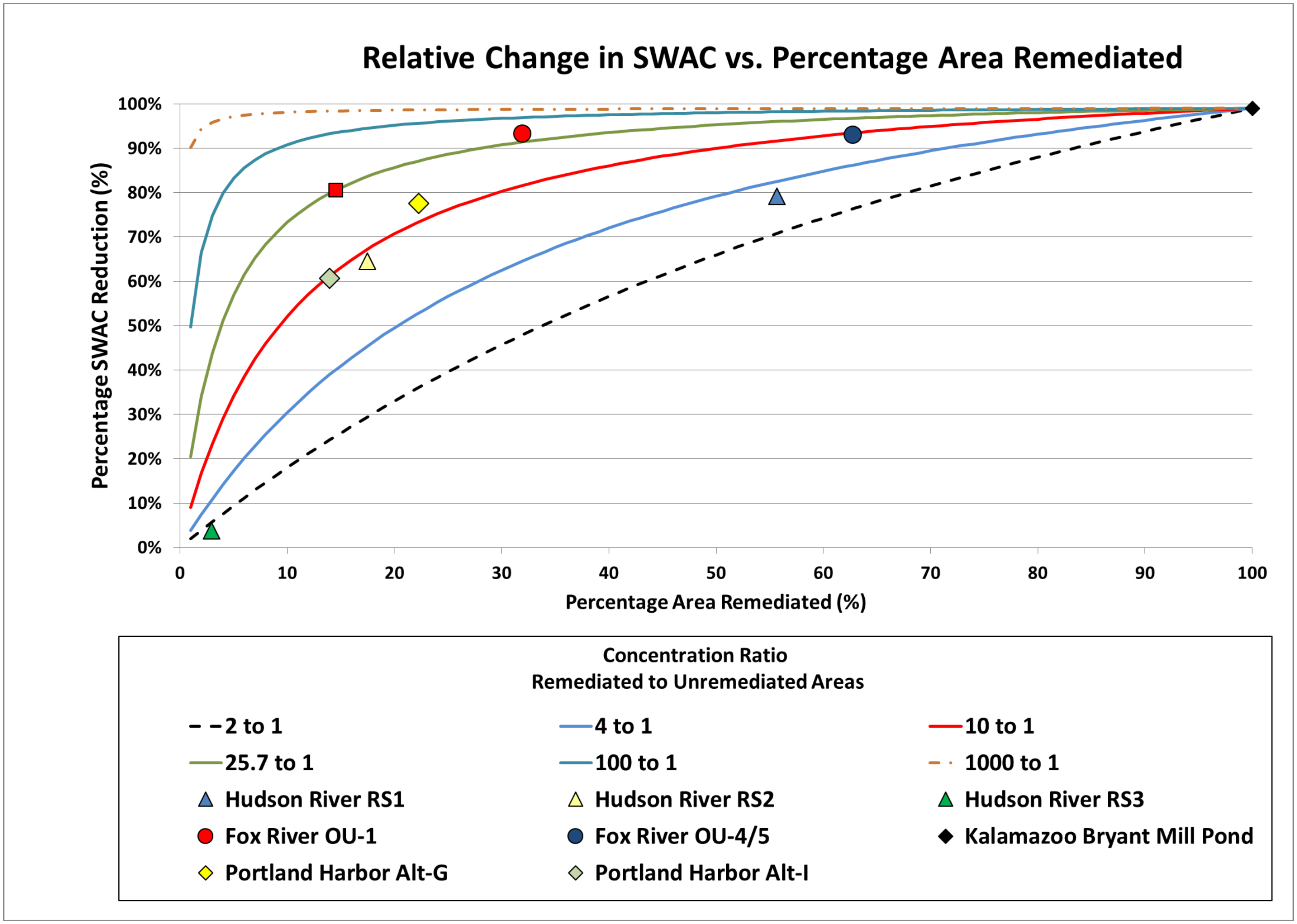


Figure I-3. Relative Change in SWAC vs Percentage Area Remediated

This page left blank intentionally.

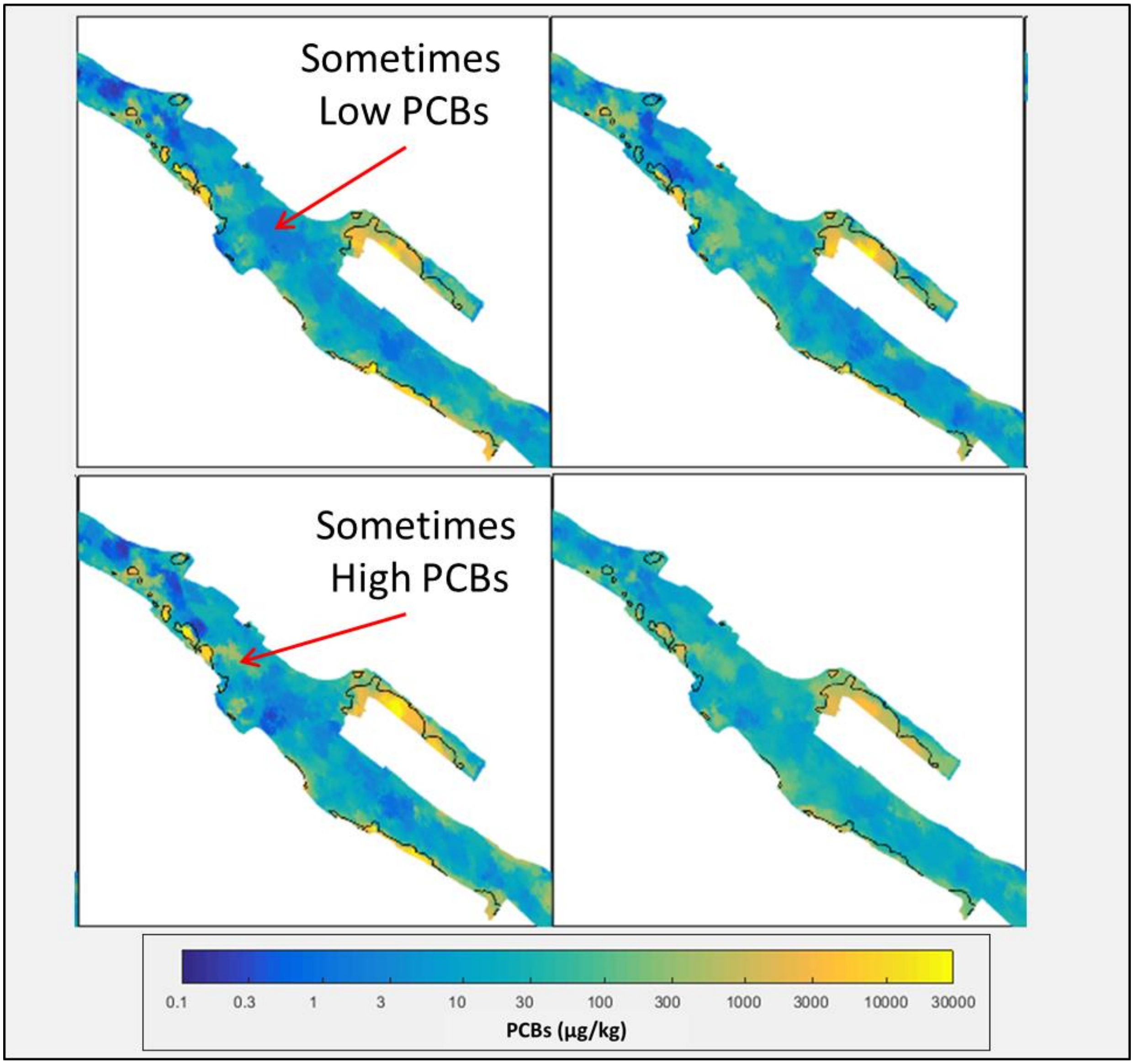


Figure I-4. Four Equally Likely Simulated Maps of PCBs

This page left blank intentionally.

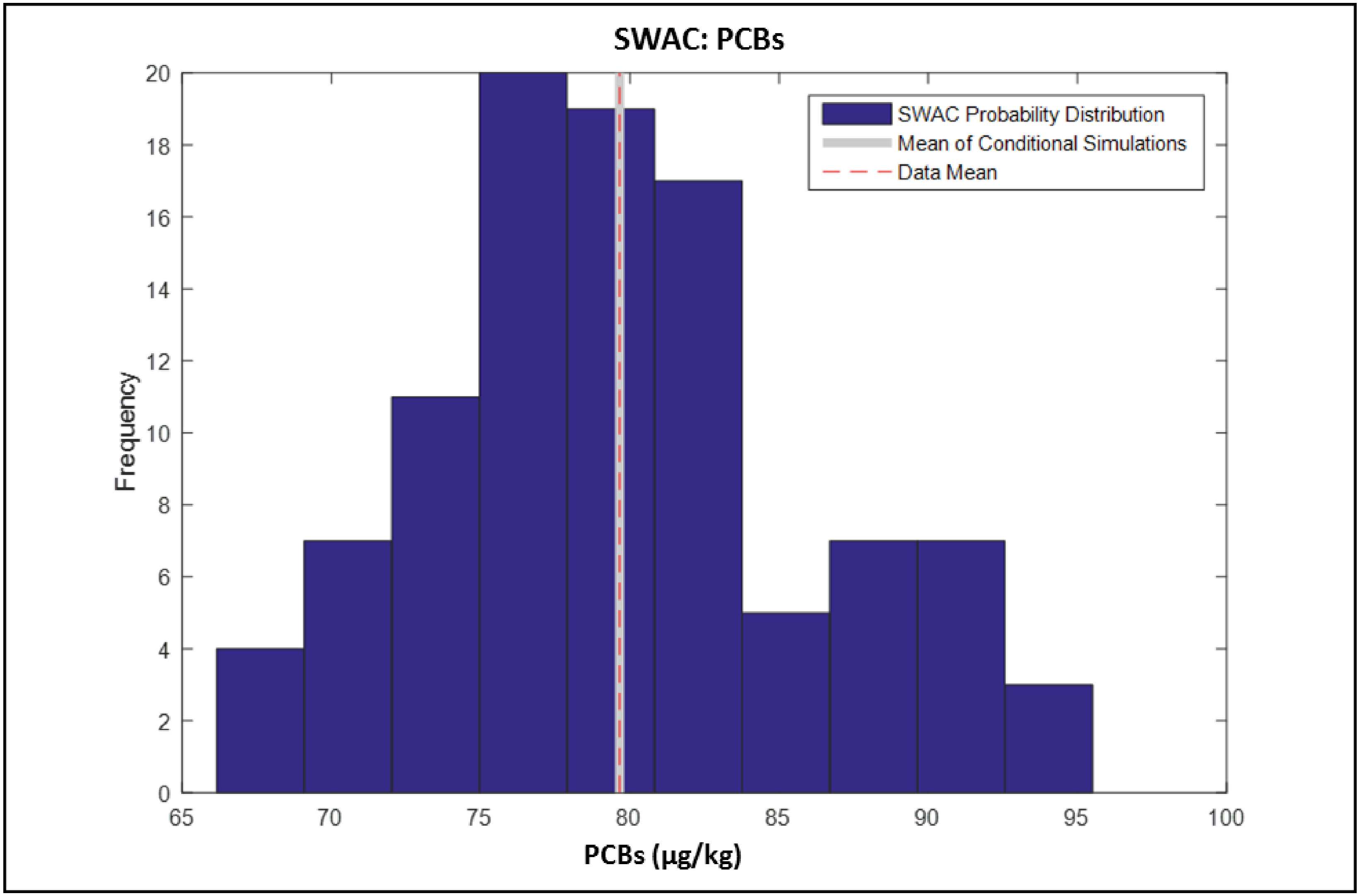


Figure I-5. Pre-Remedial SWAC - PCBs

This page left blank intentionally.

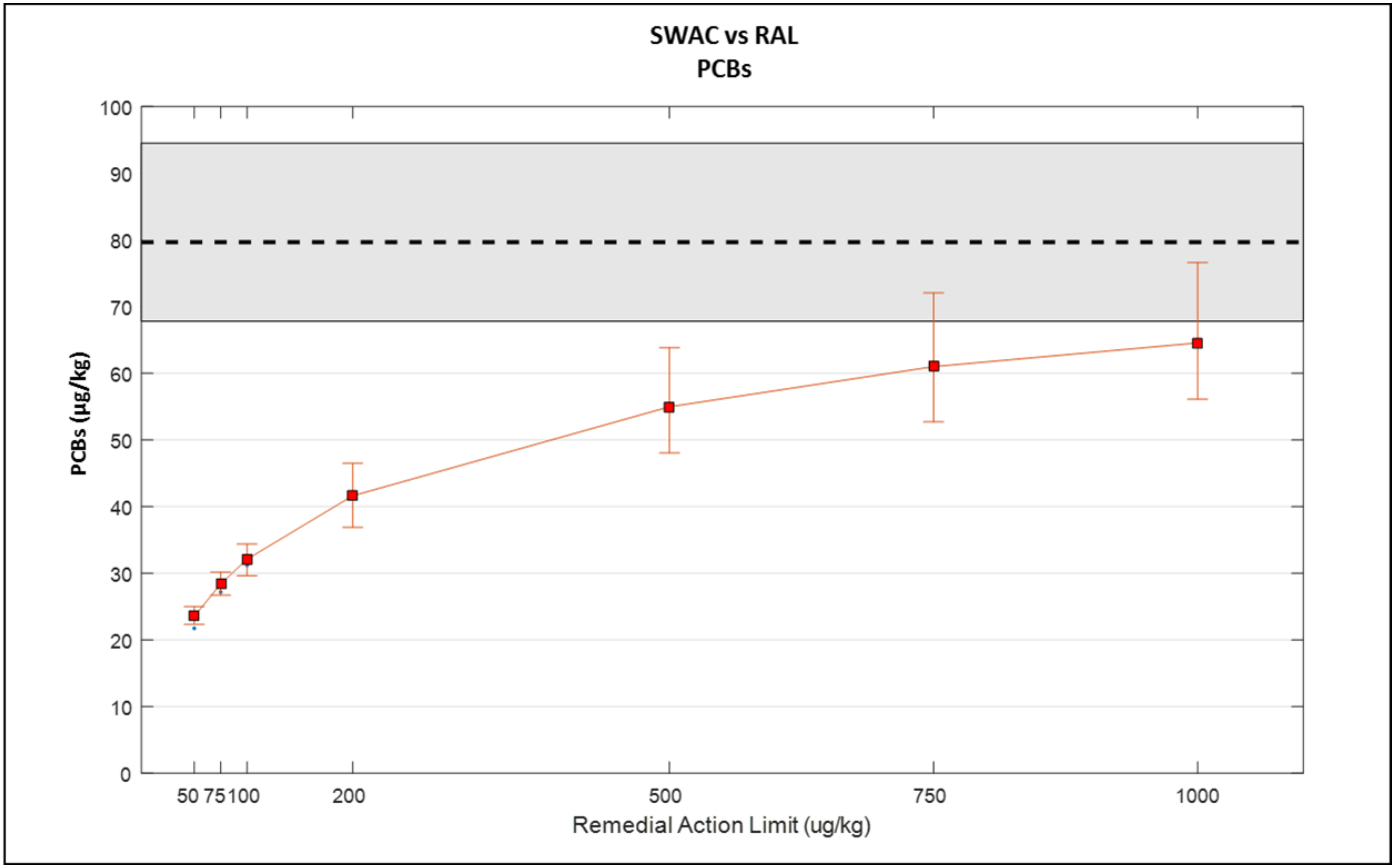


Figure I-6. Surface Weighted Average Concentration for PCBs vs. RALs

This page left blank intentionally.

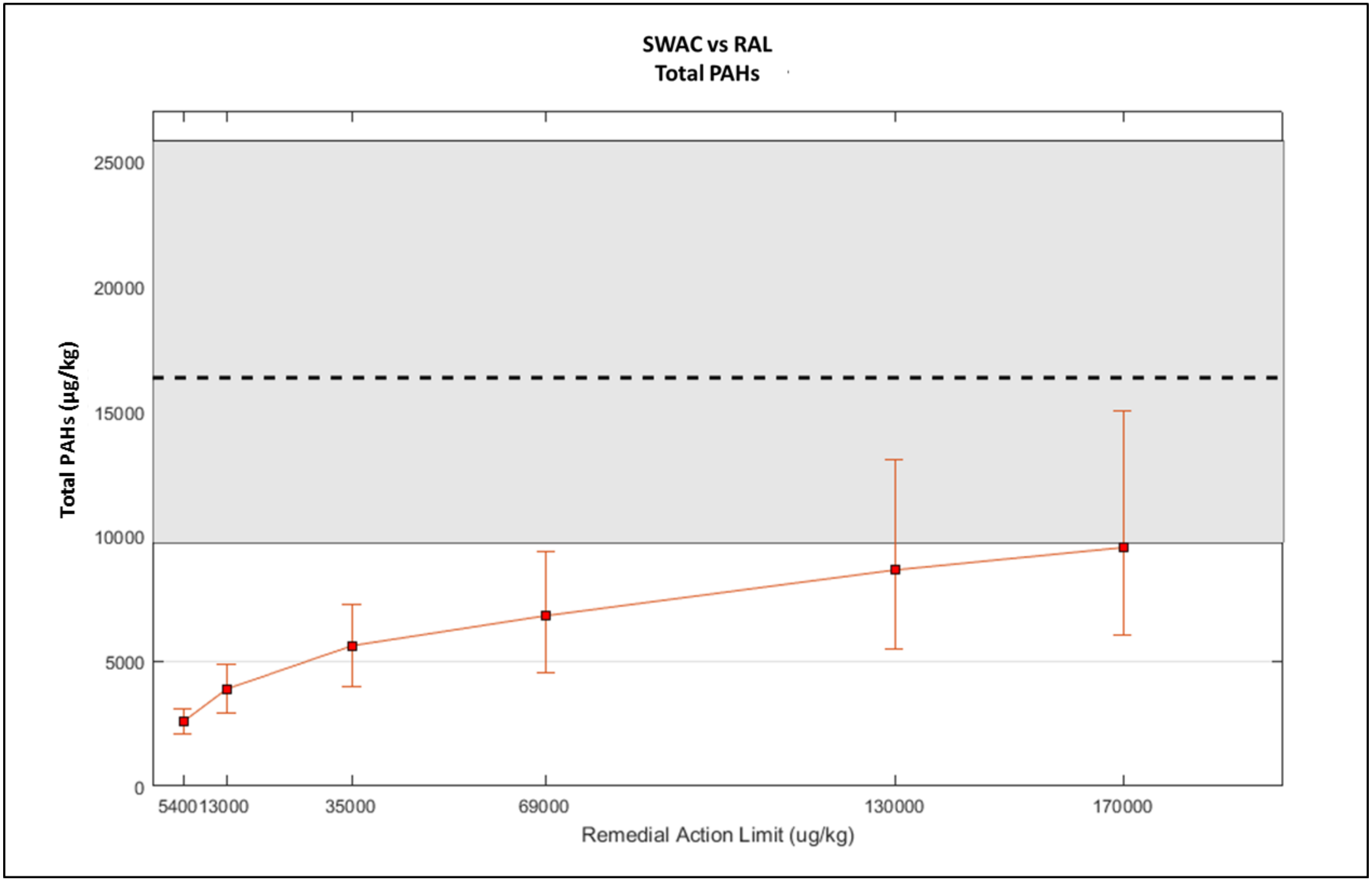


Figure I-7. Surface weighted average concentration for Total PAHs vs. RALs

This page left blank intentionally.

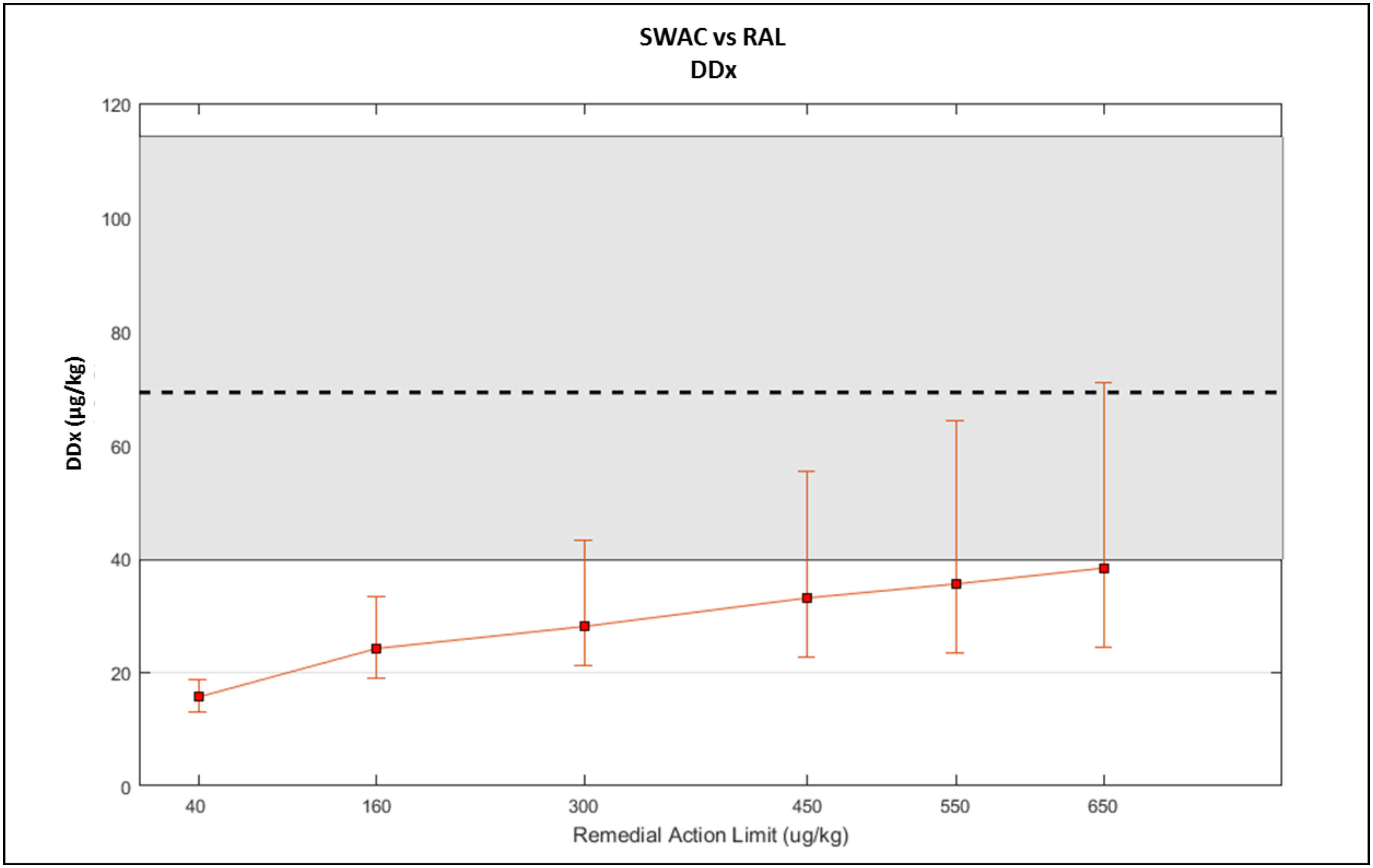


Figure I-8. Surface Weighted Average Concentration for DDx vs. RALs

This page left blank intentionally.

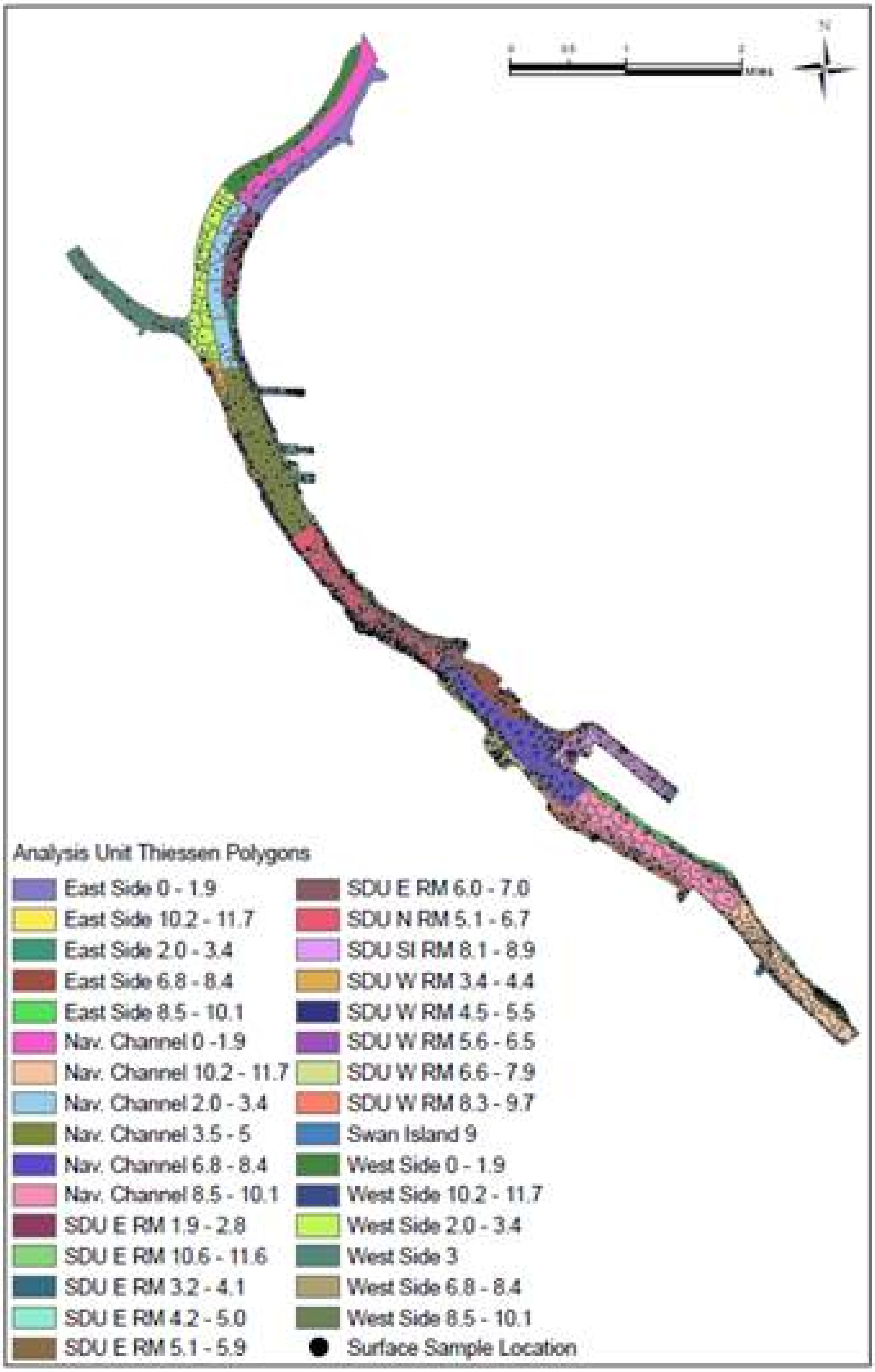


Figure I-9. SDUs and geographic areas used to develop Site-wide SWAC.